THE HARVEY CUSHING BRAIN TUMOR REGISTRY: CHANGING SCIENTIFIC AND PHILOSOPHIC PARADIGMS AND THE STUDY AND PRESERVATION OF ARCHIVES

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The Harvey Cushing Brain Tumor Registry:
Changing Scientific and Philosophic Paradigms
and the Study and Preservation of Archives

A Thesis Submitted to the
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by
Christopher John Wahl
1996

Dedicated to Ann Howard and Bernadette Parisi
in the memory of all patients, who teach more
about life than any text ever could.

This thesis prepared with the generous support of
the James G. Hirsch, M.D. Endowed Medical Student Research Fellowship
and the National Institutes of Health Cancer Research Grant

very special thanks to:
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Albert W. Diddle, M.D., Major contributor to the C.T.R. Restoration Project
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Dr. Laura Manuelidis
Mr. Bill Massa in the Sterling Library of Manuscripts and Archives
Mr. Andrew Hogan, for his help with selection of photographic materials
Ms. Terry Dagradi, in the Yale Department of Biomedical Communications
Toby Appel and Alina Ozimek in the Cushing/Whitney Historical Library
Howard M. Spiro, M.D., Director, Yale Program for the Humanities in Medicine

Dedicated to [illegible] Howard and the [illegible]
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Christopher John Wahl (Sponsored by Dennis D. Spencer). Section of Neurological Surgery, Department of Surgery, Yale University, School of Medicine, New Haven, CT.

Modern philosophies of the history of science dictate that the scientific community undergoes a depreciation of historical fact as part of the aftermath of paradigmatic shifts. In lieu of this Kuhnian model of scientific innovation coupled inadvertently to historical devaluation, it appears that the hard data and physical products of scientific research are often lost, forgotten, or destroyed as the summations they provide are incorporated or excorporated from the scientific theories they tested. As theoretical constructs evolve or disintegrate, scientific history is rewritten. However, archives, collections, and databases of data which escape destruction are often of immense value to historians of science for reasons which lie completely outside the context of their initial creation. In point of fact, their value often depends precisely on a scientist's unwitting inclusion of information which, in the environment of his research, he is unable to perceive or control. This paper examines three such collections. Harvey Cushing's Brain Tumor Registry is a document which chronicles the development of neurological surgery. It represents a remarkably complete diary of medicine and surgery in the early twentieth-century. Unexpectedly, the sublime photographic materials belonging to the Registry have inherent artistic value. The second collection represents the work of Samuel Morton and Louis Agassiz amassed to prove their pre-Darwinian hypothesis that all men evolved as separate species. Ironically, work on this racist theories produced daguerreotypes which survive today as the earliest surviving photographic images of African-Americans in this country--a valuable contribution to the black heritage. The final collection examined is the mid-twentieth-century work of William H. Sheldon, who struggled his entire career to link human morphology to psychology. His photographic archive, originally collected under somewhat inauspicious circumstances, was largely destroyed after a recent and shortsighted media exploitation. The paper condemns the senseless destruction of archival materials, especially when their value can not possibly be elucidated in the context of the present scientific and historic paradigm.

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HARVARD UNIVERSITY

CAMBRIDGE

PRESIDENT'S OFFICE

June 27, 1934

Dr. Harvey Cushing
The School of Medicine
Yale University
New Haven, Connecticut

Dear Dr. Cushing:

I have talked over the problem raised in your letter with Dr. Wolbach, Dean Edsall, and Dr. Eisenhardt, and after considering all the available evidence have decided that you are probably right in your feeling that it might be well if you withdrew your offer and moved the collection to Yale. I am, of course, very sorry that matters did not develop in such a way as to make it possible for you to have the registry here in the Harvard Medical School, but it seemed clear that unless a close connection could be worked out between Dr. Eisenhardt and some permanent member of the staff, the arrangement would not in the long run be satisfactory. Unless I hear from you to the contrary, therefore, I shall assume that you will move the collection to New Haven where you yourself can keep a finger on it.

Let me say again what a great pleasure it was to have lunch with you the other day in New Haven and how sorry I am that in this particular adventure your first ideas could not be brought to fruition here at Harvard.

With all good wishes and highest regards,

Very sincerely yours,

James B Conant

Letter from James B. Conant to Harvey Williams Cushing, June 27, 1934. Reprinted from the original, Sterling Library of Manuscripts and Archives, Yale University.

With his decisive yet apologetic letter of June 27, 1934, James B. Conant, then President of Harvard University, effectively closed the chapter on Harvey Williams Cushing's official relationship with the Harvard Medical School. The sixty-three year-old Dr. Cushing had retired from his thirteen year tenure as Moseley Professor of Surgery in 1932, and returned somewhat disparaged to his *alma mater*, Yale. At the urging of Dr. S. Burt Wolbach, Chief of the department of Pathology at Boston's Peter Bent Brigham Hospital, the esteemed surgeon had left his Brain Tumor Registry to Harvard's Warren Museum. It was an immense document comprised of over 2,200 case studies: human whole brain specimens, tumor specimens, microscopic slides, notes, journal excerpts, and over 15,000 compelling photographic negatives--materials dating from as early as 1887. It was the embodiment of Cushing's scientific odyssey which chronicled the emergence of neurological surgery as a modern medical specialty, an icon for the relentless pursuit of knowledge, and quite literally, a portrait of human misery, bravery, suffering, and triumph. However, by 1934, Dr. Wolbach was having difficulty promoting the project. His department of Pathology had little space to spare, and the Warren Museum lacked the funds to make the necessary alterations to house the archive. The correspondence merely confirmed Cushing's suspicions: his aspirations for the Registry as a permanent scientific and historic archive would never be realized in Boston.

Some years later, Dr. Conant would introduce a young Junior Fellow of the Society of Fellows of Harvard University to the history of science. Thomas S. Kuhn would later write of this interaction: "[James B. Conant] thus initiated the transformation in my conception of the nature of scientific advance."[1] Kuhn's landmark essay, *The Structure of Scientific Revolutions* (1962), forever altered the perceptions of science and history, and brought to focus the construct of the scientific community which allows--in fact conducts--the depreciation of history in the tempestuous wake of scientific advance.

It is the intention of this essay to demonstrate, in lieu of the Kuhnian model of scientific innovation coupled to some degree with historical devaluation, how the hard data and physical products of scientific research are often forgotten, lost, or destroyed while the summations they provide are incorporated into or excorporated from the theoretic constructs they tested. However, in the aftermath of Kuhn's

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It is the intention of this essay to demonstrate, in lieu of the Kuhnian model of scientific innovation coupled to some degree with historical devaluation, how the hard data and physical products of scientific research are often neglected, lost, or destroyed while the summations they provide are incorporated into or emerge afresh from the theoretic constructs they tested. However, in the aftermath of Kuhn's

"shifts in paradigm", as theoretical constructs necessarily evolve or disappear, scientific history is rewritten.

If any notion of scientific historical fact is to be realized; the archives, collections, and databases of research must be carefully preserved and reevaluated. Moreover, the thesis supports a notion that archives which manage to escape destruction will usually be of service to scientists and historians in ways which lie completely outside the purpose of their initial creation. In point of fact, their value often depends upon a scientist's unwitting inclusion of information which, in the environment of his research, he is unable to perceive or control. The novel value that well-documented scientific collections posses is *precisely* an artifact of the dynamic and amnestic nature of academic pursuit, whether the data grew out of what contemporary community now perceives to be sound principles, or were the products of misguided or biased experimentation.

Three unrelated and separate collections will be examined. Each is the endeavor of a scientist who collected data, photographic and otherwise, in a manner which he felt tantamount to the success of his research. The first, Harvey Cushing's Brain Tumor Registry, is the collection briefly described above. The Registry formed a sort of "complete works"--a document which characterizes the pinnacle of the Homeric observational method in the early part of the twentieth century. The meticulous acquisition of clinical and laboratory data by Drs. Cushing, Eisenhardt, and Bailey inductively led to the refinement of neurological surgery as a valid medical specialty. The archive survives in its relative entirety, providing the opportunity for historical re-evaluation of Cushing's work and embodies a remarkably complete diary of neurological medicine from its conception. Unexpectedly, age has leant the collection of brains specimens and riveting photographs the patina shared only by bona fide *objects d'art.* Because the history of Cushing's Brain Tumor Registry has never been fully documented in one place, a good portion of this paper will attempt to formally record the conception, organization, storage, and revitalization of the archive.

The second collection to be considered is comprised of a series of daguerreotypes, skulls, and data taken by the Swiss-American biologist and theoretician, Louis Agassiz, and Samuel G. Morton, a Philadelphia scientist and physician whose forte lay in his emperic technique. Agassiz and Morton, renown scientists of their day, founded the "American school" of *polygeny* in the middle of the nineteenth century. This theory supported the conviction that all species of animals, including man, were created separately to suit their specific environments.

Agassiz and Morton worked under conditions they believed to be objective, although a modern review of their work clearly demonstrates that the pair could not escape the propensity to confirm *a priori* convictions they shared about race and social order. In any case, Charles Darwin's *Origin of Species*, published in 1859, set forth the principles of evolution, a devastating blow to polygenic theory. However, Morton's collection of skulls and data, and Agassiz's daguerreotypes inadvertently succeeded polygeny despite their sensitive nature. The collections have recently been acknowledged for their scientific, anthropologic, and historical value.

The final collection to be analyzed contributed to the work of William H. Sheldon. Sheldon, a physician and psychologist devoted his career during the middle third of the twentieth century to the study of *constitutional psychology*. His tenets hypothesized that a person's physical constitution, or *somatotype*, held the key in some way to a better understanding of their temperamental, behavioral, even medical predisposition. Dr. Sheldon began his work at the University of Chicago, proceeded to Columbia University, and later Harvard, where he employed numerous experimental testing instruments and took a wealth of standardized photographs to this end. However, his methods fell under scrutiny--the ethical paradigm of the second half of the twentieth century questioned the participation of the elite learning institutions across the country, where matriculating male and female students were unwittingly included in the studies. In addition, Dr. Sheldon's research could not utilize the many yet undeveloped statistical concepts of error and bias--and his data is accordingly riddled with conjecture. Indeed, Sheldon and his colleagues, even with bias as an ally, could never establish a convincing correlation between body habitus and temperament, yet they refused to accept the null hypothesis. Ultimately, the sensitive predeterministic and eugenic overtones resonant in the research (which alienated much of the modern scientific and educational community) led to significant controversy. Photographs and data pertaining to W.H. Sheldon's misguided theory have been destroyed on a grand scale--extinguishing the possibility that such a massive photographic document might be available for re-evaluation through the wisdom of future generations with the luxury of hindsight.

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Brain specimen of C.L. Note quote by L. Agassiz imprinted on scale. From the Harvey Cushing Brain Tumor Registry, Yale University.

Thomas S. Kuhn's publication of The Structure of Scientific Revolutions in 1962 introduced a generation of historians and scientists to a novel and exciting world view. Kuhn, an historian of science, readjusted the frame of reference with which the scientific community perceived its foundations in an argument so elegant and intuitive, it remains difficult to refute.

Traditional views of history, particularly the history of scientific advance, recognized progress to be a more or less gradual and continual march toward fundamental truths. While no historian could deny the remarkable impacts that various individuals played on the evolution of science--persons like Galileo, Copernicus, Newton, Lavoisier, Darwin, and Einstein--the conception seemed to hold that these were unique individuals who, upon making perceptive observations, followed a logical progression which ultimately led to the establishment and acceptance of their theories.

Kuhn's hypothesis, however, insists that the procession of scientific history is a turbulent, revolutionary, and often painful process in which paradigms are violently overthrown and redefined. These paradigms radically alter the prior frame of reference within which a scientific community practices--leaving the "post-revolutionary" scientists to rethink and review past "pre-revolutionary" beliefs in a novel environment.

> Led by a new paradigm, scientists adopt new instruments and look in new places. Even more important, during revolutions scientists see new and different things when looking with familiar instruments in places they have looked before. It is rather as if the professional community had been suddenly transported to another planet where familiar objects are seen in a different light and are joined by unfamiliar ones as well.[2]

Revolution of thought, or the replacement of an existing working construct occurs through "...achievement...sufficiently unprecedented to attract an enduring group of adherents away from competing modes of scientific activity...[they are] sufficiently open-ended to leave all sorts of problems for the redefined group of

practitioners to resolve."[3] Once a revolution has taken place, scientists work within the new frame of reference, theorizing and testing their convictions with principles that the form the precepts of the paradigm. Through the careful study of nature, unexpected phenomena or incongruous data are revealed. Some are attributed to experimental error; others become recognized and ingrained as problems to be solved. As Kuhn states, "Normal science does not aim at novelties of fact or theory and, when successful, finds none. New and unsuspected phenomena are, however, repeatedly uncovered by scientific research, and radical new theories have again and again been invented by scientists."[4]

As a paradigm roots itself into a particular scientific community, it becomes more and more difficult for investigators working within their theoretical and social construct to conceive of or appreciate the preceding antiquated world views and scientific environments. This is especially true as most paradigms are considered valid for several generations of scientists. In fact, the investigators who are successfully indoctrinated into a scientific community learn of their background in the context of the paradigm in vogue--an illusory history in which the contemporary world view appears to have evolved from a logical, rational progression. The scientific revolution alters the historical perceptions of the community that experiences it, and the communities texts and publications are altered to reflect those perspectives.[5]

> Scientific education makes use of no equivalent for the art museum or the library of classics, and the result is a sometimes drastic distortion in the scientist's perception of his discipline's past. More than the practitioner of other creative fields, he comes to see it as leading in a straight line to the discipline's present vantage. In short, he comes to see it as progress. No alternative is available to him while he remains in the field...[He is] like the typical character of Orwell's 1984, the victim of a history rewritten by the powers that be.[6]

Kuhn acknowledged the gradual, and to some degree unconscious change in the study of history that preceded him. While his essay remains the definitive theory expounding the nature of change in science, historians of science before him sought to understand the significance of theoretical constructs within the context of their own historical environments. "They ask, for example, not about the relation of Galileo's views to those of modern science, but rather about the relationship between his views and those of his group...[the viewpoint] that gives those opinions the maximum internal coherence and the closest possible fit to nature."[7]

For Kuhn, and a majority of the historians who have followed him, the most radical and unsettling aspect of his theories of scientific pursuit involve the necessary removal of science from its implicit vector toward some fundamental truth. Were science following a truly objective and logical progression, one could postulate that a guiding set of rules moved the scientists from ignorance toward enlightenment. However uncomfortable, the modern scientist is now forced to accept the likelihood that innovation under the auspices of "scientific advance" are likely to lead to the ultimate disintegration of the paradigm, and a new conception of scientific order which may or may not be any more telling about the construction of nature.

To add insult to injury, the study of paradigms and history almost inevitably indicate that major paradigmatic shifts occur in concert with major changes in social belief. One can not separate the scientists from the social environments in which they operate, and the cultural context of a scientist's community must strongly dictate how he or she will conduct research. Steven Jay Gould touches upon this philosophy of science as a social enterprise:

> Facts are not pure and unsullied bits of information; culture also influences what we see and how we see it. Theories, moreover, are not inexorable inductions from facts. The most creative theories are often imaginative visions imposed upon facts; the source of imagination is also strongly cultural.[8]

Steven Gould makes light of a "curious dialectic": science is bound to and embedded in culture (often to the detriment of its objectivity); and yet, as Kuhn has hypothesized; science has the dubious capability of disrupting and uprooting its social foundations, rewriting history to suit the incoming world view.

Perhaps the final quietus toward the bankruptcy of scientific historical fact springs from this social environment which surrounds a scientist. The investigator, bound by the constraints imposed upon him by the attitudes, conventions, and spiritual or legal atmosphere in which he or she works, may forsake *integrity* for *comfort*. Because historians rely to a great degree on the reports, notes, and publications made by a scientist during a scientific endeavor, he leaves himself open to believing what may be false. The pressures imposed upon a scientist, physician, or historian may often lead to the skewed reportage of data or the omission of fact.

As this essay hopes to demonstrate, even the passage of only 50 years will radically change the content and quality of history that is recorded.

Therefore, if we choose to accept Thomas Kuhn's hypothesis, and "...relinquish the notion, explicit or implicit, that changes of paradigm carry scientists and those who learn from them closer and closer to the truth."[9], and in fact, accept that in all likelihood, they actually carry them farther and farther away; the future appears abysmal for the historian of science. Kuhn's theory, and particularly its implications for history, however, seem to exclude one variable: the creation of physical, tangible, static objects is often an inadvertent by-product of research. That is, the objects, archives, and collections of data--the actual tools which are exploited to define, refine, and establish scientific paradigms are immune to subjective interpretation. When sufficiently preserved, they can be utilized by the scientist, historian, or archaeologist to make profound inferences about the past. Steven Gould capitalized upon this phenomenon in *The Mismeasure of Man*: "Scientists are used to analyzing the data of their peers, but few are sufficiently interested in history to apply the method to their predecessors. Thus, many scholars have written about Broca's impact, but no one has recalculated his sums."[10]

Ironically, the passage of historical and scientific paradigms actually imparts to such collections certain values which could never have been imagined by the investigators who create them. Because a scientist is unable to perceive of the inquiries that a *future* historian or scientist (working within an entirely different paradigm) will be likely to ask; he is unable to voluntarily ensconce the data pertinent to the future research. Nor could he or would he be interested to obscure such information; often the future query has little or nothing to do with his work.

Intuition hints that to be useful, these archives are likely to satisfy at least three conditions:

1.) They must be sufficiently large enough to provide the future historian information that can withstand statistical analysis.
2.) They are usually sufficient in breadth enough to allow the historian to extract comprehensive information from a host of available variables, and make conclusions which can be generalized to broader subjects and modes of thought.
3.) They are often inclusive of data pertaining to the social, intellectual and political atmosphere in which they are created. Even when the archives are collected by persons who were quite famous in their day, the physical collection may yield

information which directly contradicts previously accepted biological or scientific conception.

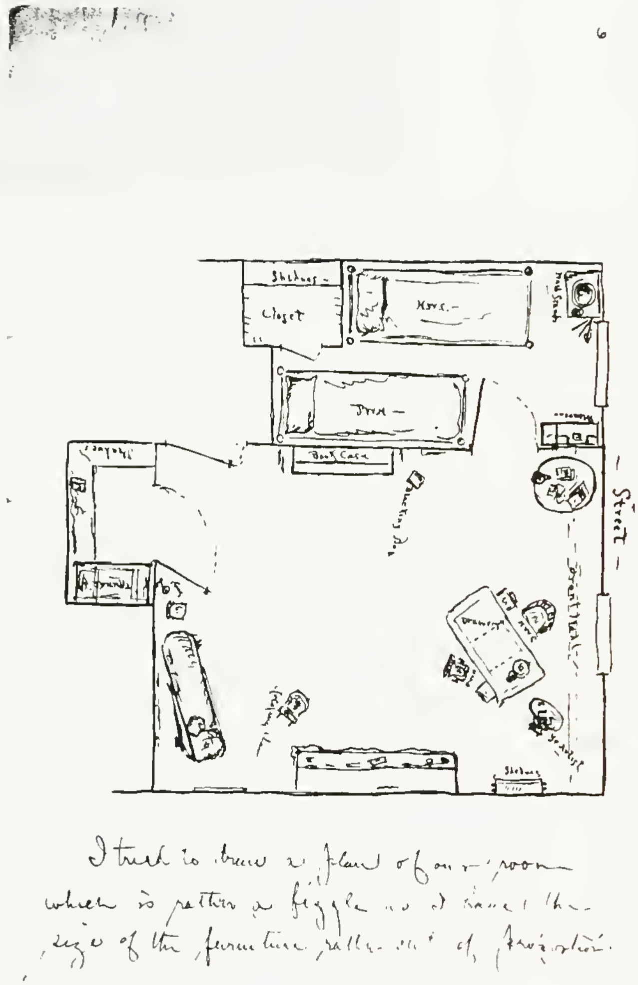
It appears, then, that scientific archives--physical products of the labors of research--provide at least one stronghold of historical fact in a Kuhnian model of scientific advance. Looking back into these archives with the clarity of hindsight, possible freedom from confounding political, social, or spiritual variables, and with the careful aid of statistical, scientific, and theoretical tools of a new paradigm; it is possible that a profound light will shine on the science of the past.

Biography of an Archivist: Harvey Cushing's Formative Years

Life is short, the Art is long...
Hippocrates

Even a perfunctory examination of the photographs, specimens, and records that comprise the Cushing Brain Tumor Registry acquaint one, to a great degree, the character of its creator. The Registry represents an embodiment of Harvey Williams Cushing's passion for meticulously recording, ordering, reordering, and interpreting information. His sketches and notes document a struggle to discern the difference between inconsistency, irrelevancy, insignificance, and the ever elusive *sine qua non.* The registry is rivaled only by Cushing's personal diaries, for he made daily entries in both for a great number of years. Indeed the late Dr. John Fulton, Harvey Cushing's devoted biographer, faced an inordinate but enjoyable challenge to limit his definitive biography to a mere 754 pages: from Cushing's earliest days, a continual theme in his life was his obsession with observation, innovation, and tireless documentation--principles which permeated all of his endeavors. The evolution of his Brain Tumor Registry is intimately tied to his life experience.

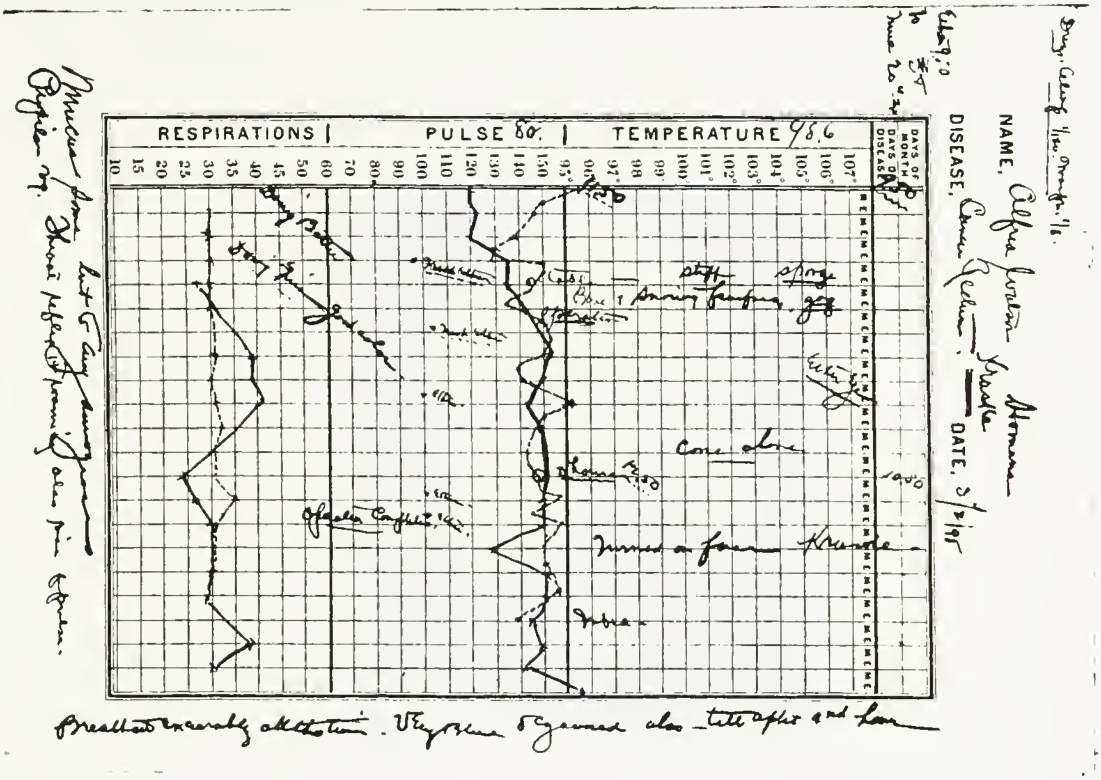
He was born in Cleveland on April 8, 1869--the youngest in a family of ten children in which medicine had been a long family tradition. Cushing was a mediocre student in his earliest years at Yale, but was eventually stimulated by his work with physiological chemist Russell H. Chittenden. Even from his time at Yale, H.C. showed an impressive propensity to document information in excruciating detail. Diary entries and letters to his family and parents were accompanied by cartoons, diagrams, and drawings (in addition to his ubiquitous pleas for money). Participation in gymnastics competitions and the varsity baseball team attest to Cushing's skill as an athlete, much to the chagrin of his somewhat puritanical father, who frowned upon the social and athletic activities which distracted the younger man from his studies.



Two letters written from Harvey Cushing to his mother. From Sterling Library of Manuscripts and Archives, Yale University.

Photograph of Harvey Cushing on "Varsity 9" baseball team at Yale. Cushing appears third from the right in the top row. From Harvey Cushing/John Hay Whitney Medical Historical Library, Yale University.

Cushing's record at the Harvard Medical School showed him to be maturing academically--he was an exemplary student there. Working as a second-year student in 1893, an unfortunate incident paved the way for Cushing's first major contribution to medicine. Students routinely administered ether sponge anesthesia to patients during the surgical lectures. During one such lecture, while operating with Dr. Charles B. Porter, Cushing's patient succumbed before the entire class. Distraught by the experience, the neophyte approached Dr. Porter with the mind to leave medicine altogether and work to repay the patient's family.[11] Porter dissuaded Cushing, who immediately set to work with his close friend and classmate, Amory Codman, on "ether charts"--graphic representations of an anesthetized patient's heart and respiratory rates. The charts were used initially just by Cushing and Codman, who competed to administer the best anesthesia judged by the patient's postoperative behavior on the ward. To the modern scholar, the idea seems almost sophomoric; but in 1893 the charts revolutionized surgery by greatly curbing complications and deaths due to anesthetic complications.[12]



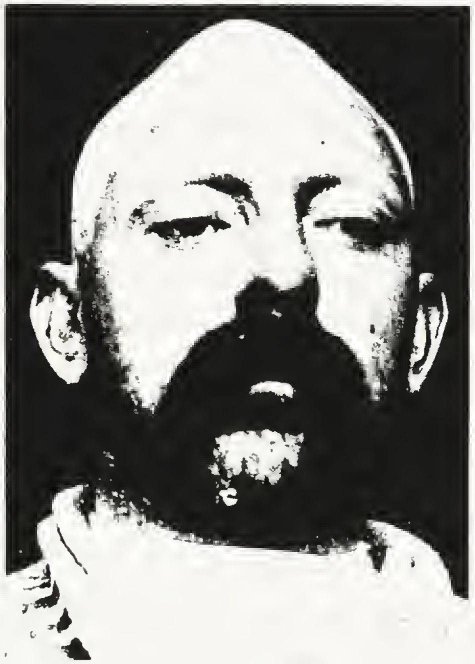
Copy of "Ether Chart" kept by Harvey Cushing and Amory Codman at Harvard Medical School. 1895. From Harvey Cushing/John Hay Whitney Medical Historical Library, Yale University.

Within two years of the ether charts, while serving as a surgical house officer at the Massachusetts General surgical service, Harvey Cushing had his first opportunities to witness surgery on the human brain. At the time, neurosurgery had been attempted by only a handful of individuals, most notably the great London surgeon Victor Horsley. Its practice was limited to desperate and usually fatal attempts to trephine the skull and relieve intracrainial pressure. J.W. Elliot, who Dr. Cushing would later describe as "[one of the] most brilliant and daring surgeons of his day" studied for a short while with Horsley to learn his methods of tumor localization based on patient symptoms. Then, in June of 1895, a 31 year-old man entered Elliot's service with an obvious growth atop his skull. The man had been struck on the head three years prior, and the tumor had grown to become

Copy [illegible]

Within two years of [illegible] as a house officer at the Massachusetts General Hospital, Harvey Cushing had his first opportunities to witness surgery on the brain [illegible]. At the time, neurosurgery had been attempted by only a few [illegible] the great London surgeon Victor Horsley. [illegible] attempts to [illegible] Dr. Cushing would later describe [illegible] of his day" [illegible] localization based on patient symptoms. [illegible] entered Ellis's service with [illegible] struck on the head three years prior and [illegible]

symptomatic. Elliot chose to operate with Cushing assisting. The pair removed a large, spongy, vascular, purple tumor--one which Harvey Cushing would eventually name a meningioma. Although the operation ended in tragedy (John Maloney died a few hours later and Cushing performed the autopsy); the event marked the young surgeon's first, and certainly an influential venture into the neurological surgery.[13]



J.M., a patient who marks one of Cushing's first experiences with surgery on the brain. From Harvey Cushing/John Hay Whitney Medical Historical Library, Yale University.

1896 finds Harvey Cushing looking to continue his training at the Johns Hopkins Hospital. Word spread about the catamount care and progressive philosophies of the hospital, under the guidance of William Osler, William Welch, William Halsted, and H.A. Kelly. Cushing first wrote to Osler, but after nothing developed, he approached William Halsted, the professor of surgery. Negotiations persisted for several months, ending in Harvey Cushing's eventual appointment to Halsted's surgical clinic. The J.H.H. compensation for a surgical resident at the time amounted to $100 per annum.

Serendipity had been truly faithful to the young Harvey Cushing. A mediocre student at Yale, an exemplary medical student at Harvard, and perceptive and accomplished house officer at the M.G.H. with a penchant toward difficult surgery; Cushing had set the table for perhaps the greatest intellectual feast of all time--a surgical residency guided by the meticulous, exacting, and *ailing* Halsted.

symptomatic. Elliot chose to operate with Cushing assisting. They uncovered a large, spongy, vascular, purple tumor—one which Harvey Cushing would eventually name a meningioma. Although the operation ended in tragedy when Mahoney died a few hours later and Cushing performed the autopsy, the event marked the young surgeon's first, and certainly an influential exposure to neurosurgery.[18]

J.M., a patient who [illegible] of Cushing's [illegible]
From Harvey Cushing's [illegible] Medical Historical Library, Yale University.

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William Halsted, also an outgoing Yale graduate (Class of 1874), studied surgery at the Columbia College of Physicians and Surgeons, and had proven himself as a teacher at the Belleview Medical College in New York. He spent time in Europe often, studying with the great physiologists and physicians there, and fostered the concept of coupling clinical and laboratory investigation to American practice. Elizabeth Thomson makes the point clearly: "[Halsted's] surgery was a work of art, and the example he set--for careful study of each case, exquisite operative technique, and close examination of tissues in the laboratory afterward--was to influence American surgery for many years."[14] Indeed, Halsted can be credited with creating a sort of "American school" of painstakingly slow and remarkably bloodless surgical technique that would surpass the state-of-the-art, even in Europe. Halsted's laboratory work, ironically, eventually became a burden to him. He and three colleagues, while using each other as subjects conducting experiments on the use of cocaine as a local anesthetic, each became addicted to the drug. Halsted, the only one of the four who managed to salvage his career, fought gallantly against his addiction, but relied heavily upon his unknowing resident, Harvey Cushing.[15] This is evidenced in a number of personal memos to H.C. while he worked under Halsted's service. In one Halsted complains of a splitting headache and cold: 'If my patients for today do not care to wait until Monday, please operate upon them and oblige. Yrs sincerely, W.S. Halsted.' To the note Cushing replied with consternation, 'Ms. Taylor did not choose to wait. Femoral hernia with tuberculous peritonitis.'[16] As the proverb goes: 'It's an ill wind that blows nobody good'; Cushing benefited eminently from Halsted's misfortune. Over the course of his time as a surgical resident, he had been imparted the exacting technique that came to characterize the rest of his career and he had been given ample opportunity to practice it unabated in one of the most progressive surgical clinics in the world.

The young Dr. Cushing continued to mature as a surgeon and academic, and as he did so, his interest in neurological surgery became clear. By November of 1889, again had the opportunity to boast his propensity toward innovation and reportage with another case operating upon the central nervous system. Lizzie W. was the wife of a brawling bartender who received a gun shot wound to her cervical spine. For the case, Cushing employed an old, hand-held cathode ray tube which he brought with him from his time in Boston. Before leaving the M.G.H., Cushing and Codman saw a demonstration of Roentgen's "X-ray device" at an exposition in New York. The prescient and innovative pair excitedly purchased a primitive hand-held unit for use in the hospital. Many films, mostly experimental, were taken with the

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(Left) William Halsted's 1904 Johns Hopkins operating room. Cushing stands next to the scrub nurse across the table from Halsted (bent over). (Right) X-ray taken during case of bullet wound to the spine, later published as "Haematomyelia from gunshot wounds of the spine. A report of two cases, with recovery following symptoms of hemilesion of the cord." *American Journal of the Medical Sciences*. Both from Harvey Cushing/John Hay Whitney Medical Historical Library, Yale University.

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both purity of focus and worldly sophistication."[18] Osler and Halsted, who recognized the unrefined genius in their shared mentee, suggested he take a year in Europe. The mentors arranged for Cushing to come into contact with individuals who would eventually be among the most influential scholars in modern medicine: surgeons Victor Horsley and Theodore Kocher, and physiologists Hugo Kronecker, Angelo Mosso, and Charles Sherrington to name a few. In his diaries, there is an alchemy, as H.C. moves from London, where he nearly flees from Horsley's near butchery[19], to Paris, where he is "[distressed by the] poor, old dirty, overcrowded wards...careless examinations--ragged looking temperature charts and so on ad infinitum..."[20]; to Berne, where he marvels at Kocher's technique: "..the J.H.H. outdone."[21]

Europe bears witness to the fruition of another of Harvey Cushing's endowments: his nurtured propensity to collect. Before Cushing ever came into contact with Osler, Halsted, or the Johns Hopkins Hospital, he had been under the historical tutelage of his father, Henry Kirke Cushing--a great bibliophile in his own right. During Cushing's first years at Johns Hopkins, William Osler soon took the young resident under his wing. Dr. Thomas Duffy gives us a possible reason why:

> Cushing entered Osler's life already well equipped with a pedigree, character and interests that must have strongly appealed to Osler; the surgical resident was an eerie reincarnation of the older man. Osler, like so many other mentors, had chosen for his mentee a newer-reflection of himself.[22]

Osler fed Cushing's passion for book collecting and encouraged him on his European pilgrimages to see various medical historical memorabilia. He introduced him to Vesalius early on--a prelude which would be the center of H.C.'s bibliographic passion for the next forty years. While in Padua, Cushing sought the amphitheater where the visionary anatomist carried out his dissections, and searched for William Harvey's *Stemma*--the student coat of arms traditionally inscribed upon the walls of the universities. The enthusiastic Cushing wrote to his father: "It's a great sensation to stand up there where Wm. Harvey, Malphigi, and others without end, have crowded elbows to watch the progress of the anatomical reawakening of the XVI hundreds."[23] Never forgetting the present, H.C. stayed an extra day in Pavia to secure for himself and the hospital an adaptation of the Italian physiologist Riva-Rocci's primitive pneumatic blood pressure cuff.

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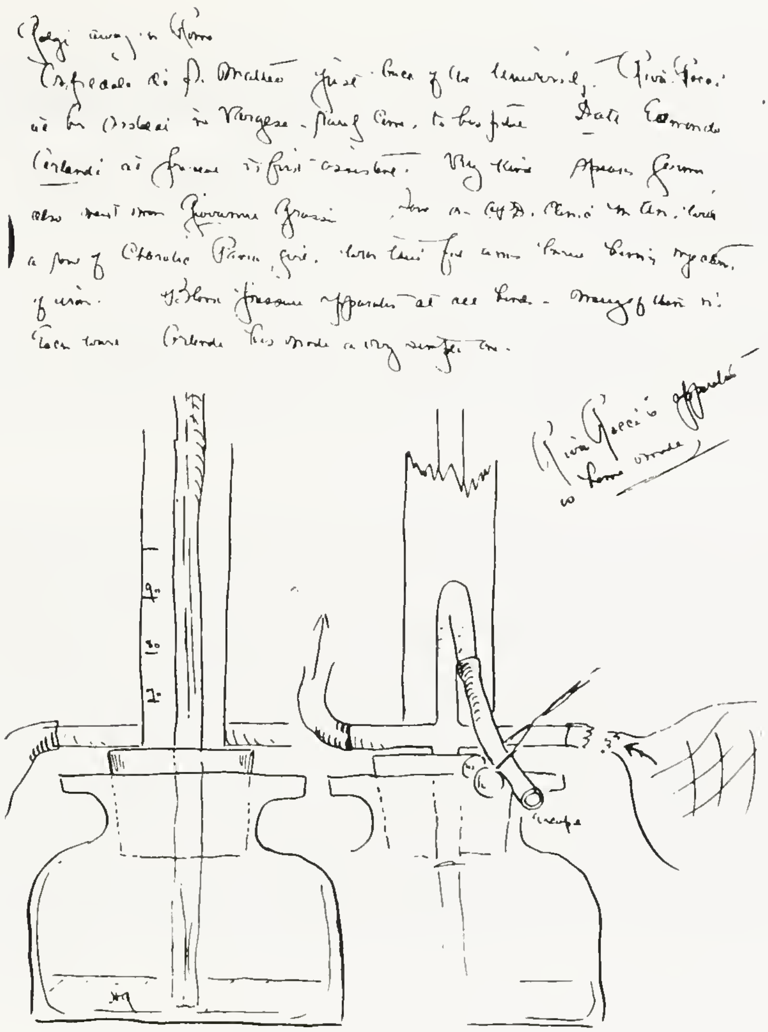

Harvey Cushing's sketch of Riva-Roccis pneumatic instrument for the recording of blood pressure, drawn while traveling in Pavia, Italy, 1901. From Harvey Cushing/John Hay Whitney Medical Historical Library, Yale University.

No less telling, and perhaps more influential was Cushing's fascination with the "Hunterian Museum". John Hunter, a colorful Scot who years before had transformed surgery into a legitimate science, founded the field of experimental pathology. His museum, at the Royal College of Surgeons, represented a collection of over 13,000 specimens of different species in various states of health and disease. His brother William Hunter, an eminent bibliophile, amassed one of the greatest private collections of medical books in existence. It was willed to Glasgow when he died. Cushing, deeply affected by both archives, returned to the Hunterian Museum many times while overseas.

Harvey Cushing's [illegible] specimen drawn while [illegible] in [illegible], 1901. From Harvey Cushing [illegible] The Whitney Medical Historical Library, Yale University.

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Cushing finished out his time in Europe working with Charles Sherrington on cortical localization experiments on monkeys. He prepared for his journey home in August, packing his bags, and his beautifully illustrated notes, diaries, and sketchbooks. What a profitable year it had been. It seemed that Europe gave to Cushing the clarity of character, talent, and any confidence that he lacked. His already flourishing *curiosa felicitas* for recording, collecting, and documenting details had been amplified. His one year abroad studying with the greatest of scientists both past and present composed the overture to Cushing's next 38 years--and what the new millennium had in store for all of surgery and history.

> From Kocher, he learned the power of leadership and example in imbuing students with technical skills and thoughtful practice. Kronecker and Sherrington taught him the fulfillment of scientific inquiry and the utility of its application to clinical practice. His profound friendship with Osler and his exposure to the life and times of the Hunters, Vesalius, and historical interests imbued him with the recognition that the preservation of posterity and the transmission of knowledge through great libraries and collections were vital issues of learning. The synthesis of his experiences and the recognition that neurosurgery would be the next great uncharted territory of surgery enabled him to establish the course of the 40 years after his return from Europe. Last, he recognized with a clarity born only of a great intellect that the establishment of a novel discipline and school of thought could be accomplished only by the absolute commitment and unwavering vision of an individual.[24]

The "Skilled Finger": Genesis of the Cushing Brain Tumor Registry at Johns Hopkins

Give me a lever long enough, and a fulcrum strong enough, and single-handed I can move the world.
--Archimedes.

Dr. Cushing returned to the Johns Hopkins Hospital in September eager to take his position alongside William S. Halsted, and specialize in cases involving neurological surgery. The appointment was reached with a degree of animosity, as Halsted first suggested to Cushing that he may fare better in Orthopaedic Surgery. Cushing, while a chief resident, already helped to establish William S. Baer as the director of an orthopaedic clinic at Hopkins; and Baer , in his turn, traveled across Europe to work with the outstanding orthopaedic surgeons of his day.

Harvey Cushing seemed to be against insurmountable odds. Even with the rapid advancement of medicine, surgery on the brain remained largely the same as it had been 400 years earlier in the time of Ambroise Pare.[25] In 1876, William Macewen of Glasgow, relying on data obtained in neurological clinics successfully diagnosed a brain tumor, but permission to operate had come too late and his diagnosis was confirmed at autopsy. London's Sir Rickman Godlee, nephew of Joseph Lister, successfully performed the first intracranial operation on a living patient in 1884. America saw its first brain tumor removal by W.W. Keen at the Jefferson Medical College in Philadelphia in 1887. Even Victor Horsley, whose surgical technique so disappointed Cushing in Europe, had operated upon both the brain and spinal cord by 1887.[26] Each of the surgeons reported frankly discouraging results, with only occasional success. Cushing researched the J.H.H. experience with surgery on the brain and found that over the previous decade, 36,000 patients had been seen at the hospital, of those only 32 received a diagnosis of brain tumor, and of those, 13 had been referred to surgery. However, only 2 patients ever made it to the operating room, and both died before leaving the hospital. Irregardless, Cushing pressed the issue. He was eventually offered a position as an Associate in Surgery, given the opportunity to direct and teach in Halsted's Hunterian Surgical Laboratory, and expected to help manage Halsted's

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busy surgical clinic.[27] In return, Harvey Cushing earned his dubious distinction--he would be referred any patient requiring surgical treatment of the nervous system.

Cushing immediately continued work which he had begun overseas on the measurement of blood pressure, specifically its relationship to intra-operative patient status and experimentation with its relationship to inracranial pressure. He worked closely and in correspondence with Dr. George Crile in Cleveland, known for his contributions to shock management. Cushing first presented on "Some Experimental and Clinical Observations Concerning States of Increased Intra-Cranial Tension" as the Mutter lecture in Philadelphia (December, 1901).[28] By January of 1903, he and Dr. Crile amassed enough data to present to an enthusiastic panel at Harvard Medical School on "Consideration of Blood Pressure". Their talks aroused enough interest that a committee was created within Harvard's Department of Surgery, its express purpose to evaluate the utility of Riva-Rocci's apparatus. In the words of John Fulton, "The committee was formed: it met and remet and deliberated at length on each occasion; eventually it was decided that the skilled finger was of much greater value clinically for determination of the state of the circulation than any pneumatic instrument. Consequently the work was put aside as of no significance."[29] Despite the conclusions of the Harvard committee, Cushing incorporated the measurement of blood pressure into his operative schema.

While Harvey Cushing's reputation as a physiologist blossomed immediately, his recognition in the surgical clinics slumbered. The prescient Dr. Cushing could not have anticipated the difficulties he would endure on the road to developing his neurosurgical technique. By 1904, three years after he began his somewhat exclusive practice, his success rate with intracranial tumors was meager. He wrote to his father; "The successes are so far between in cranial work that when they come life is quite easy--the failures are very depressing."[30] In addition to his own doubt, he faced the occasional jibing from Halsted (it is rumored that the chief once remarked that he didn't know for whom to feel more pity--Cushing or Cushing's patients). H.C. had the unfortunate luck to attract the attention of a Baltimore Sun reporter, who wrote with fidelity on patients who came great distances to undergo operations by Hopkin's "brain surgeon"--never to leave the hospital.[31] Cushing's long time Harvard friend and colleague, Amory Codman, did not help matters with his 1905 publication on a "Summary of the surgical experience at the M.G.H."[32] Results in Europe, at Harvard, and at the J.H.H. seemed to indicate that the future held little promise for the foundling specialty.

To his credit, Harvey Cushing had sporadic luck with meningioceles. Likewise, he was one of the first surgeons to act on W.G. Spiller's suggestion that relief from tic douloureaux (trigeminal neuralgia) might be obtained by surgical excision. The operation proved highly successful, and came to be Cushing's staple throughout the difficult early and (to some degree) experimental years.

In 1902, a golf ball sized piece of brain tissue, or more to the point, the *conspicuous absence* of a golf ball sized piece of tissue, provided the definitive catalyst to a series of events ultimately leading to the creation of Cushing's Brain Tumor Registry. Cushing's opportunities at intracranial tumor surgery were few and far between, and successes were rare. Still, he regularly examined all tissues removed during surgical cases, a habit he learned from both Halsted and Kocher. Following the removal of a pituitary cyst from a Ms. Mary Donnelly; the Johns Hopkins Pathology Department "misplaced" Cushing's tissue specimen. The young surgeon, prone to fits of anger which occasionally drew admonition from Dr. Osler, failed to contain his fury. He insisted that from that day on, he be allowed to personally retain all specimens removed during his operative cases or autopsy. Welch and MacCallum agreed, and at least in theory, the Harvey Cushing Brain Tumor Registry was born.

In fact, the stage had been set for the Registry a long time coming, and even if the J.H.H. never committed its *mentis gratissimus error*, it is likely that Cushing would still have demanded to keep the record. The event represents a certain psychological investment that Cushing made in his art--he would build a library toward his school of thought.

The next several years saw evolution in the technical aspects of neurosurgery. Neurology, physiology, and then pathology had already advanced far beyond the capacities to remove intracranial tumors. Steady advances in operative technique, predominantly in the control of bleeding, intracranial pressure, and sepsis characterized Cushing's forte. Despite the discouraging early results, in 1905 W.W. Keen recognized Cushing's advancement and commissioned him to write a chapter on surgery of the head for his upcoming text. Keen requested an 80-page contrubution, but in 1907 received Cushing's 800 page manuscript illustrated liberally with over 200 original drawings. Eventually, Keen edited the submission to 250 pages with 154 illustrations. Publication of the work marked Cushing's *coup d' grace*--neurological surgery found its focus in the United States.[33]

Established as a center for the study of the radical specialty, Cushing attracted residents to Johns Hopkins beginning in 1908. The residency, like the surgery demanded the highest degrees of perseverance, stamina, and discipline--Harvey Cushing was no easy person to please. "He allowed no conversation while he scrubbed up, and insisted on absolute quiet in the operating room. Each patient became his absolute responsibility, and the operation a fierce contest between him and the forces that threatened life..." wrote Elizabeth Thomson. Eric Oldberg continues; "Although always meticulous and careful, he, like all surgeons, was sometimes faced with catastrophic accidental occurrences. He always rose to the occasions instantaneously and magnificently, and to be associated with him in such a battle was nothing short of emotionally moving." Those who were unable to "rise to the occasion" at pace with Dr. Cushing received severe tongue-lashings, and even if they were undeserved, the neurosurgeon did not make it a frequent habit to apologize.[34] [35]

Within ten years of his return from Europe, Harvey Cushing had sufficiently refined and introduced most of the techniques he would require for the rest of his career. He turned his eyes somewhat more inward, utilizing his obscure collection of tumor specimens, microscopic slides, and photographs to review his labors up to 1910. The results were presented in Cleveland as "The Special Field of Neurological Surgery". His clinic admitted a total of 180 patients referred to him with some type of neurological tumor. Of the most recent one hundred in whom an operation was performed, Cushing's mortality rate was 11 per cent. Only three of the postoperative deaths occurred in the last 50 patients. Cushing understood, as Elizabeth Thomson wrote: "This was partly due to the fact that patients were beginning to present themselves before the outlook was completely hopeless, since early signs of tumor were being recognized more readily. Patients less frequently arrived at the clinic already blind, because ophthalmologists had become aware of what conditions indicated pressure on the optic nerves..."[36] Indeed, the surgeon began to amass and publish data on his series at an increasing rate. As he saw patients who were not yet at death's door, his success with tumors increased, and in turn, patients were more likely to agree to an operation. When the outcomes were unfortunate, autopsies were conducted in approximately 90 per cent of intra-hospital deaths. Cushing perhaps even exceeded that average in contributions to his bizarre collectanea. Many of his specimens were seized under "inauspicious circumstances"; a rumor perhaps, but one which appears to have been ubiquitously

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shared by Cushing's residents.[37] One such tale appeared in Percival Bailey's somewhat scurrilous collection of Cushing anecdotes, *Pepper Pot*:

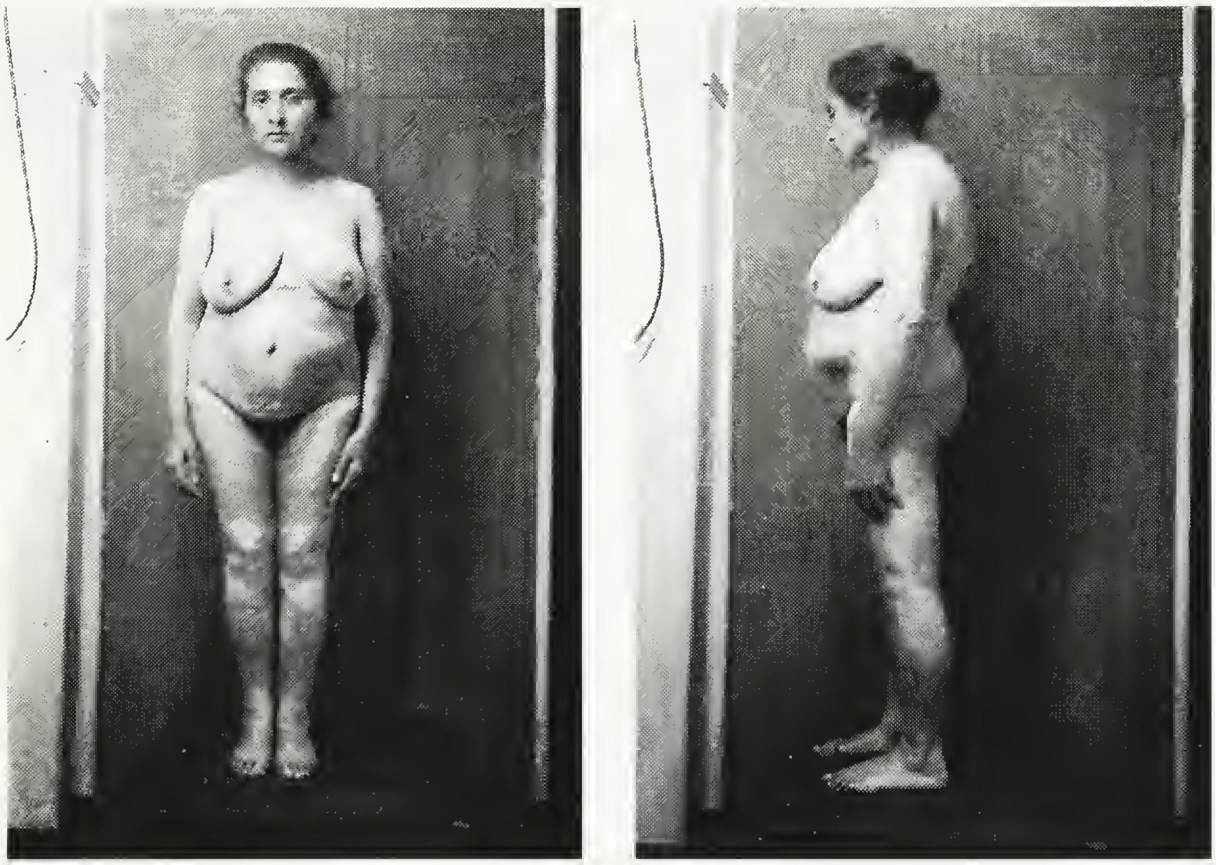
> Once, when unable to obtain a brain at autopsy, Cushing was obliged to admit failure and remarked before Martin, "I would give anything for that brain."
> A couple of hours later, Martin entered his office and remarked laconically, *"Goodbye Dr. Cushing."*
> "What do you mean?"
> *"I'm Fired."*
> "Why?"
> *"Well, you said you wanted that brain and I was taking it out for you when Dr. Howland came along."*
> Dr. Cushing seized the telephone and told the superintendent that he would resign if Martin left. Martin stayed. How [Cushing] fixed that matter with the family I never learned, but it must have cost him plenty.[38]

Prior to December 1910, Dr. Cushing had seen about 20 patients with disfiguring tumors of the pituitary gland. The contemporary literature, including Osler's remarkable textbook of medicine, recognized only two perversions of the structure: *acromegaly*, also called hyperpituitarism or Marie's disease resulted from gland hypertrophy; and hypopituitarism, or underdevelopment of the gland. To Cushing, however, the study of this gland and its disorders became a passion. Fulton writes:

> Cushing was always fascinated by the circus, particularly by the sideshows where he obtained histories of the giants, fat women, and midgets, and any other freak that might happen to be on display. In this way he made friends with many circus personalities and over the years managed to keep in touch with several well-known giants and midgets. Sir Arthur Keith, the distinguished curator of the Hunterian Museum, consented some years ago, on Cushing's insistence, to removing the top of the skull of the famous Irish giant whose skeleton had long been on display in the Museum, in order to ascertain the condition of the sella turcica where the pituitary body would have been. Sure enough, the sella was grossly enlarged and there was evidence that there had been a sizable intracranial extension of the pituitary tumor.[39]

Progeria. This is one of the few photographs from the Harvey Cushing Brain Tumor Registry in which Cushing himself appears. From Harvey Cushing Brain Tumor Registry, Yale Universtiy.

(Above) Classic presentation of acromegaly, anterior and lateral views of patient. (Below) Acromegalic skull (left) and control. Both from the Harvey Cushing Brain Tumor Registry, Yale University.



Ms. K., anteriior and lateral views. This 1912 presentation of *dyspituitarism* mystified Dr. Cushing. Sixteen years later he would describe "pituitary basophilism" or "Cushing's disease" based on this and similar cases. From the Harvey Cushing Brain Tumor Registry, Yale University.


Two cases of hypopituitarism. From Harvey Cushing Brain Tumor Registry, Yale University.

Beginning as early as 1909, H.C. introduced a third term, “dyspituitarism”, to describe syndromes in which patients displayed signs of both hyperpituitarism and hypopituitarism. He was well aware of Victor Horsley’s early attempts at pituitary removals. Horsley reported his success with 10 cases between 1889 and 1906, however, the mortality rate in London for any intracranial operation approached 44 per cent.[40] Cushing first attempted to remove the tumors via a subtemporal route, but having little luck, he adopted the transsphenoidal passage through a sublabial incision. (In fact, he would later return to a subtemporal technique after 1925).[41]

Cushing presented the results on his first twenty patients to the New York Academy of Medicine as part of the Harvey Lecture series in 1910. The lecture was a resounding success, and H.C. labored over the next two years with another 27 cases. He published the entire series of 47 cases in 1912 under the title *The Pituitary Body and its Disorders. Clinical States Produced by Disorders of the Hypophysis Cerebri.* The book drew largely from Cushing's collection of photos, specimens, and histories--separating the individual case studies into those resembling hyperpituitarism, hypopituitarism, and dyspituitarism (and then subclassifying those into 5 subgroups). Unlike any work which could be published today, *The Pituitary Body* presented little in the way of physiology, pathology, chemistry; it is predominantly a book of observations with and end comment on incidence, symptomatology and therapy. However, the work put the diagnosis of pituitary disorders into the hands of physicians everywhere. Where previously there had been only the macabre--giants, dwarfs, and bearded women; headaches, blindness, adiposity, and polyuria--suddenly there existed an explanation: malfunction of the hypophysis. Physician Leonard P. Mark illustrated the epiphany when describing his own experience: "For some fifteen or twenty years, each day when I looked into the glass to brush my hair or to shave, there was a typical acromegalic literally staring me in the face. Yet I never recognized the fact."[42] The pituitary became the primary focus of much of Dr. Cushing's scientific and clinical career; in 1927 he once again reflected on acromegaly, "Nature in her ugliest mood conceived such a malady."[43] With the 1912 publication, Dr. Harvey Williams Cushing firmly consolidated his repute as the foremost authority on surgery on the human brain--particularly for the extirpation of tumors. In addition, his numerous contributions to aseptic and hemostatic methods of surgery had always earned the notice of medical institutions across the country, and he received invitations from several of these, notably Yale and Case Western Reserve, to exit his position under Halsted at Johns Hopkins, and pilot his own surgery department as chief.

Harvard, with the generous posthumous support of Peter Bent Brigham, set to establish a benchmark hospital: one which promised to serve the underserved populations of Boston and the United States, and pledged to compare favorably in quality of care with any existing institutions. The trustees wooed Dr. Cushing, offered to let him aid with the design of the hospital and its policies, establish an autonomous section of neurological surgery, and to serve as the surgeon-in-chief of the progressive hospital as the Moseley Professor of Surgery. The chance fortune to fashion a department in his own image stood as a once-in-a-lifetime opportunity,

and Harvey Cushing departed Baltimore in October of 1912 to establish his surgical laboratory in Boston, and await the opening of *his* wards.

Louise Eisenhardt, her "Confounded Little Book", and the Monographs: The Organization of the Cushing Tumor Registry at Harvard

...games are scarcely worth playing unless one keeps a score.
Harvey Cushing, *Intracranial Tumors*

Cushing's transition to Boston went relatively smoothly. He seized the time available while work continued on the hospital to integrate himself into the scientific and intellectual community. When the wards finally opened, he immediately set to work. The task was undoubtedly simplified by Cushing's decision to bring with him to Boston his entourage of residents and research scientists. Indeed, he also brought the notes, sketches, and specimens, and even attempted, albeit unsuccessfully, to steal away the official Johns Hopkins Hospital records from his surgical series. By 1915, things were flowing effortlessly, and Harvey Cushing again made public his statistics concerning the mortality rates for intracranial operations for tumors. This time he astonished his colleagues, submitting to the Journal of the American Medical Association an overall surgical mortality of only 8.4 per cent. In contrast to the death rates of other leading neurological surgeons of the time: Kuttner, Krause, Eiselberg, and Horsley, whose figures ranged from 38 to 50 per cent, H.C.'s results seemed baffling.[44] However, he satisfied his skeptics by offering an explanation for the discrepancy: infection and sepsis played heavily into the disappointing percentages shared by each of the other surgeons; for Cushing, only a handful of patients succumbed to infective complications. He attributed the remarkable lack of postoperative infection to his stringent sterile procedures, and to the careful closing of anatomical layers, particularly the dura, while operating.

Despite the tensions and difficult atmosphere created by the War overseas, Cushing began a period of intense, prolific writing activity, utilizing his unofficial registry, and especially the numerous pen-and-ink sketches outlining the critical steps of each case. He compiled and recompiled his results, publishing liberally in journal reports, and set to work on his second major monograph--*Tumors of the Nervus Acousticus*. To this end, he hired a young, enthusiastic editorial assistant to work with him full-time. Her name was Louise Eisenhardt.

1917 brought American participation in the war, and Harvey Cushing had been appointed to help establish Harvard Medical School's satellite military hospital: the Base Hospital No. 5. The surgeon complied, somewhat to his consternation as his work would be interrupted at home, and dutifully departed for France--leaving the young Ms. Eisenhardt to see the monograph through publication. This task was completed so sophisticatedly, that Dr. Cushing acknowledged solely his assistant's efforts in the dedication.

Harvey Cushing capitalized upon his situation overseas to continue his observation and research. Indeed, he received stern reprimands from his commanding officers for continuing his research efforts, and particularly because the obsessive surgeon refused to speed or alter his painstaking technique in the name of expedience. In addition, Cushing continued his frank and revealing diaries, and made no effort to conceal his true feelings about his colleagues, the army, or the war in these diaries or his letters stateside. In one such entry, which was later published in his collection of war memoirs, *From a Surgeon's Journal*, Cushing made the following chilling observation: "...there are two groups of people in warfare--those organized to inflict and those organized to repair wounds--and there is little doubt but that in all wars, and in this one in particular, the former have been better prepared for their jobs."[45] While his frank reports eventually won him significant acclaim at home, they were ill-appreciated overseas, and on one occasion, he even faced court martial for his reflections.

Observations of a different kind, however, brought into focus many trends which proved to be useful to military medicine. Cushing's innate need to witness, record, and characterize events, brought with him from childhood and intensified by his successful training, led him to publish medical reports even when completely outside of his element during the war. One such paper, "A study of a series of wounds involving the brain and its enveloping structures" appeared in the British Journal of Surgery. It presented his experience with traumatic head injuries, noting his steady refinement of technique and gradual fall in operative mortality. Again, much of the noted fall could be attributed to his better understanding of the injuries; as part of the report, he devised a nine-grade scale of injury indicating successive stages of damage. He found that the status of the dura, particularly its absence of or degree of penetration, represented the most accurate prognosticator of survival. The majority of postoperative deaths from head injury during World War I directly related to intra-cranial infection.[46]

Upon Cushing's return home, he immediately set back to work on matters of intra-cranial tumors. Louise Eisenhardt remained on as his assistant, and in addition, he was approached by a young graduate from the Northwestern Medical School: Percival Bailey. Bailey had the opportunity to witness a craniotomy as an intern, and came to Cushing curious about the possibilities of brain surgery. In addition, he had received a Ph.D. from the University of Chicago after completing his M.D. The pair met for the first time while Cushing operated, Bailey reporting to have won approval by identifying for the chief a "Ballenger Swivel-knife", invented by a professor of rhinology at the University of Illinois.[47]

Percival Bailey's principal interest lay in the staining, identification, and classifications of pathological tissue--a fact which made him a valuable resource to Dr. Cushing's scientific pursuits. Bailey harbored a temperament perhaps too similar to "the chief", for while the physicians set common eyes on scientific problems, they only occasionally saw common solutions. Their relationship was at times volatile (Bailey having left Dr. Cushing's service on two occasions after fierce differences in opinion), but almost always mutually profitable. The neurosurgical caseload and clinic, boiling with activity on the heels of Harvey Cushing's growing reputation, stole away from the surgeon's available time to pursue his scientific research. In turn, Bailey lacked sufficient interest (nor the faculty by Cushing's and his own account) to hone his surgical skills enough to operate on the brain or spinal cord. In short, the duo developed a somewhat dysfunctional, oftentimes tenuous, but fruitful co-dependence. Bailey set to work, attempting with little supervision to decipher H.C.'s diagnostic technique of perimetry (visual field analysis which helped to localize tumors), and to work at classifying his operative cases, and materials from his previous years.

After their initial meeting, Bailey never received an official appointment. Within a year, he left again for the University of Chicago, where he studied with Dr. Hassin, a professor renown for his techniques of tissue staining. On one occasion, Bailey made some preparations from removed tissues in which Cushing could find no tumor. Dr. Cushing had been so impressed with the slides that he invited Percival Bailey to return to the Brigham as the Arthur Tracy Cabot Fellow, for 1920-21.[48] At the same time, Louise Eisenhardt, spurred by her own interest in Cushing's work and the laboratory, and perhaps out of necessity created by Cushing and Bailey's fiery relationship, matriculated at the Tufts Medical School in Boston. Bailey again left Cushing in 1921, presumably with the hope of finding smoother waters. He later wrote of his relationship with Dr. Cushing: "We disagreed often,

sometimes vigorously. When the tension became too great I went away for a while. But I always came back. My debt to him was incalculable."[49] It must have been a tumultuous time for Harvey Cushing, his assistant often away to school, Bailey in and out of the laboratory, and Sir William Osler, his long-time friend, colleague, and mentor had passed away in 1919. With the dutiful help of a number of particularly outstanding residents, Gilbert Horrax chief among them, Cushing pressed ahead with his surgeries, and passed much of his spare time preparing the manuscript for his biography of Osler (which had been specifically commissioned to him by Lady Osler).

With 1922 came the *tout ensemble* of Harvey Cushing's surgical, scientific, and humanitarian pursuits. Bailey again returned to Boston and started with some degree of autonomy the program for the histological study of neurological tumors. Louise Eisenhardt, who never officially left H.C.'s service, began to keep her obsessively detailed records on Cushing's operations and follow-up, acting it would appear, somewhat as a liaison between the surgeon and neuropathologist. Cushing, with the help of his passionate resident staff, operated daily, reserving early mornings and evenings to write. In addition, Cushing brought onboard Mildred Codding, a medical artist who studied with Max Brodel, the German-born illustrator employed at the Johns Hopkins, and a staff photographer to aid with the work.

The protracted study was financed primarily by the Phillip H. Gray Fund. It had been established in 1923 by Ms. Gray, in memory of her husband, who had succumbed to a malignant glioma. The Fund appropriated $10,000 per year for ten years to be utilized toward the study of tumors of the glioma type. In addition, another grant, donated by Mr. Chester C. Bolton of Cleveland (in gratitude to Cushing for his care of son Charles after a diving accident), supplemented the Gray Fund some years later. All in all, the project cost an estimated $30,000 per annum--the sum required to purchase materials and pay salaries for the research. Additional funding became available occasionally through wealthier patients who agreed to pay exaggerated fees for Cushing's service. The balance was provided by Dr. Cushing himself, who paid from his own pocket detracting from the $5000 per year he maintained throughout his entire 20 years at the Peter Bent Brigham Hospital.[50] The Harvey Cushing Brain Tumor Registry functioned as an integrated research tool; much evolved since the early days at Johns Hopkins, and Mary Donnelly's lost pituitary cyst.

Bailey and Eisenhardt took it upon themselves to organize and reclassify the tumors which the paramount neurosurgeon had collected over the years. Many of

these were ill-defined, the collection in some degree of disarray, and the vast diversity of the tissues did not readily suit themselves for classification. Eisenhardt, soon to be Dr. Eisenhardt, not surprisingly selected neuropathology as her principal interest. As part of her records, she contacted each patient on a regular basis (usually the anniversary of their surgery), to establish statistics on the natural behavior of the tumor types: some patients would return to the clinic, their tumors regrown and in need of palliation--others never again required readmission; a single surgery provided the cure.

All the while, Cushing's operative mortality percentages continued to plummet. However Eisenhardt, the savvy young neuropathologist (incidentally, the first female neuropathologist) knew of Harvey Cushing's somewhat competitive, obstinate nature. Rather than face the skepticism of critics who might question Dr. Cushing's absurdly low mortalities, Dr. Eisenhardt kept the surgical "score" in what came to be known as "The Little Black Book". Existence of the book was well-established at the Brigham, its contents subject to curiosity, and its whereabouts a complete mystery. Even Dr. Cushing (especially Dr. Cushing) had never been granted access to the document. Yet, its contents eventually divulged the case results, diagnoses, and mortality percentages for all tumor types operated upon at the Peter Bent Brigham from 1922 until the end of Cushing's career. The book forcasted the event of his 2000th verified tumor operation, an event of some celebration at the Brigham. As an aside, it was not until the occasion of Dr. Cushing's 70th birthday party, long retired from the operating room and teaching at Yale, that the venerable surgeon burst into Louise Eisenhardt's office and demanded the document from her secretary, Betty McCarthy. With prodding the flustered and assistant reluctantly gave the "Black Book" to the intrepid Dr. Cushing. He presented the book to his colleagues at the party with the following playful statement:

> Had it not been for this confounded little book which [Dr. Eisenhardt] was prone to consult at awkward moments, the operative and case mortality percentages for the meningiomas would have been found much lower and the end results much better. For had I been left to myself, the temptation to exclude a case here and there to improve the figures would have been irresistible...[51]

By 1924, the histological laboratory ran smoothly. A paper on the medulloblastomas was well received both in Philadelphia (a presentation to the A.N.A.) and at a meeting of the Harvard Medical Society.[52] Bailey worked furiously

with the tissues from the operating room and the preparations belonging to the collection. Eventually, he surmised that each of the many varied tumors might have a common cellular origin. In December of 1924, he called Dr. Cushing into the laboratory, believing that he had come to a solution of this "glioma problem". Utilizing the tissues and natural histories (as determined by the black book), Percival Bailey arranged these various *glial tumors* (tumors arising from cells which form the supporting matrix within the brain) into an evolutionary tree--making careful correlation's between their histological appearance and their clinical behavior. Clearly, his occasional sabbaticals from Cushing's laboratory had been valuable to the research: one had taken him to Madrid to study the cellular staining and study methods of Ramon y Cajal and del Rio Hortega, the other off to France for a Guggenheim Fellowship in pathology. Bailey hoped to spend more time more carefully defining his categorization of the gliomas, but Dr. Cushing, eager to present some results during the Cameron Lectures in Edinburgh, insisted they press ahead to publication. The neuropathologist once again became annoyed with Dr. Cushing's magisterial drive and left Boston. The cavalier Dr. Cushing wrote the final chapter on the monograph, and saw the book through to publication personally by 1926. *A Classification of the Tumors of the Glioma Group on a Histogenetic Basis with a Correlated Study of Prognosis* won instantaneous worldwide acclaim.[53] [54] [55] Cushing seemed to be in an unprecedented fury of activity--his Pulitzer Prize winning biography: *The Life of Sir William Osler*, had been published just one year before.

In the operating room, Harvey Cushing continued to work much as he had since 1910. He had made several contributions along the years: the ether charts, the blood pressure cuff, the neuro-diagnostic utility of the X-ray, a novel approach to the gasserian ganglion, and the silver hemostatic clip to name a few. However, the most radical advance in neurosurgical instrumentation came in 1926, with the introduction of electro-surgical methods to the neurosurgical operating theatre. Bovie, employed by the Harvard Cancer Commission, developed an apparatus specifically designed to help with the removal of cancerous growths. The machine capitalized on the previous work in electrosurgery done as early as 1908 by DeForrest, and used in general surgery by Dr. W.L. Clark. Bovie had refined the technology to give precise, clean and cauterized incisions.[56] Cushing, who's office sat just down the street from Bovie's laboratory, recognized the role for such a device in his operating room, and invited the physicist to spend several months working with him to specifically adapt the machine for his purposes. The pair

worked for nearly half a year to perfect the instrument, a time in which Cushing operated incessantly, and wrote little. Cushing's operative note from his first attempts with the device described the event as "a perfect circus--many ringed"--the operating room needed electrical rewiring, the theatre was filled with members of the New England Surgical Association (and a number of Frenchmen coughing with colds), the medical student blood donor fainted, and the whole affair became overwhelming for Cushing's assistant resident of two days, Briton Hugh Cairns, who had to be replaced in the middle of the case by Gilbert Horrax.[57]

The year of cultivating "the Bovie" for use on the brain was clearly an arduous one, which Cairns would later compare to the Battle of the Marne. However, once suited to its purpose, the instrument allowed H.C. to reoperate on many tumors previously abandoned secondary to their vascularity, and it gave Cushing the confidence to bring to the operating theatre many cases which, without the hemostatic precision of Bovie's tool, could never have been attempted. This seems to be confirmed by a glance at Eisenhardt's book, which shows a multitude of reoperations, and a slight rise in overall operative mortality for the years of 1927 and 1928. Cushing made electrosurgical methods the subject of the 1927 Macewen Memorial Lecture in Glasgow, and for the *Lancet.* Both reported on his experience with olfactory groove meningiomas removed utilizing the device. The next year, he published jointly with Dr. Bovie on 547 operations performed with the aid of the new instrument.[58] Indeed, in a relatively short time, Cushing made electrosurgical techniques an integral part of his complicated art.

During the subsequent few years, Harvey Cushing continued his rabid work in the laboratory and the operating room. He played host to several scholars and scientists from across the world, and as Halsted, Kocher, Sherrington, et al had done for him, he in turn acted as a mentor and role model for the next generation of visiting neurological surgeons. 1929 brought the 13th International Physiological Congress to Boston, and Cushing and all the members of the Harvard Medical School laboriously prepared for what became "one of the largest international gatherings of scientific men ever held in the United States."[59] One of the highlights of the congress was Cushing's operation under local anesthetic for Ivan Pavlov, the famous Russian physiologist for whom Cushing had great respect. The patient was said to have spoken on several occasions throughout the operation, and the 80 year-old physiologist, quite excited about the whole procedure, agreed with enthusiasm to autograph a piece of steak (with the Bovie) for Dr. Cushing. The somewhat

baroque fillet has been preserved with the Cushing Tumor Registry, and is now on display in the Cushing/Whitney Historical Library at Yale.

By 1930, Cushing knew well that in two years he would be expected to relinquish his position as the Moseley Professor of Surgery at Harvard. He himself and Henry Christian, physician-in-chief at the Brigham, set the retirement age at 63. He again received overtures from Yale and Johns Hopkins to continue his work away from Harvard. These overtures both included provisions for the aging Dr. Cushing to hold a position as a Professor of the History of Medicine--Cushing's private collection of books was already renown. But Cushing politely declined, preferring instead to see what provisions might eventually be made available in Boston. In April of 1931, Louise Eisenhardt approached Dr. Cushing with some interesting news. Her "Black Book" indicated that he approached his 2000th verified tumor operation. He had completed 189 verified tumor operations at Johns Hopkins, and completed the remainder at the Brigham. Somewhat to the consternation of the surly surgeon, the event was held with some degree of pomp and theatrics, filmed for posterity before a considerable audience (including two small boys perched in a tree outside the large operating room windows). Dr. Cushing refused to fully cooperate with the filming, but the resultant footage remains adequate. The Brigham staff gave to Dr. Cushing a silver cigarette box as a momento of the occasion.

Louise Eisenhardt helped Cushing compile results of his 2000 verified cases for the meeting of the International Neurological Congress to be held in Berne, Switzerland. Indeed, the paper "Intracranial Tumors. Notes Upon a Series of Two Thousand Verified Cases with Surgical-Mortality Percentages Pertaining Thereto." heralded a certain culmination of Cushing's life work.[60] This would be Cushing's final presentation of his operative mortality statistics--still riveting to his colleagues--and it was only fitting that it occurred on the occasion of his pilgrimage back to Berne, where 28 years before, working with the likes of Kocher and Kronecker, Cushing somehow decided to embark upon his surgical odyssey into the human cranium. William H. Welch, during the particularly enthusiastic ovation that Dr. Cushing received after presenting the results, leaned to his neighbor in the audience to make a bold, but in all likelihood true statement: "Cushing is undoubtedly the outstanding medical figure of the world today."[61]

Harvey Cushing's work proceeded into 1932, evidenced by his description earlier in the year of *pituitary basophilism*--an ACTH-producing tumor of the hypophysis. Cushing had been perplexed by the disorder since before his 1912

monograph on the pituitary. At least one of the cases in the 1912 monograph--that of Minnie G., had led him to introduce *dyspituitarism* as a third alternative to hypo- and hyperpituitarism. Thirty years of carefully documented case studies finally allowed Dr. Cushing to decipher the histopathologic, clinical, and surgical presentation of this tumor. It is perhaps fitting that the constellation of symptoms and the disorder eventually came to bear his name--*Cushing's disease.*

Emotionally prepared as he might have been, Harvey Williams Cushing became the disapprobatory victim of the policy which he helped to author. When 1932 came around (bringing Cushing's 63rd birthday with it) he was already in quite poor health. His vasculopathy, partially a result of the polyneuritis he contracted during the war, no doubt aggravated by his incessant cigarette smoking, prohibited his walking any distance without rest on the wards, and he could no longer stand through long operations. While he never made a plea to recant upon the retirement policy, his memos regarding his resignation to A. Lawrence Lowell, then President of Harvard University, are quite ascerbic. Evidently though, Cushing had a realistic appreciation of his handicaps; he reluctantly but wisely passed an offer to continue as chief of neurosurgery at Case Western Reserve: the position his successor at Harvard, Elliot Cutler, had just vacated.

Dr. Cushing summered again in Europe, and to his chagrin, he returned to a quite different Peter Bent Brigham Hospital. Elliot Cutler considerably reorganized the surgical clinic in Cushing's absence. Knowing H.C.'s dictatorial tendencies, he stood hard and made it clear to his predecessor that the senior's clinical role at Harvard would be minimal. Horrax already departed to the Lahey Clinic, and Cushing's entourage had been replaced by an unfamiliar junior staff. To add insult to injury, Cushing was given only a small suite in place of his previous offices.[62] Despite his somewhat humiliating surroundings, Cushing and Eisenhardt began work reviewing tissues, specimens, photographs, and records pertaining to another type of tumor, the *meningiomas.* He had completed monographs on many of the tumor types, and specifically on the glandular and glial varieties. This final monograph would serve to complete the scientific study Cushing intended to conduct on his surgical series of 2,209 verified brain tumor operations. Numerous institutions once again courted the venerable neurosurgeon. Richard Light described his predicament:

> He lived in this tomb-like isolation for a year, unable to make up his mind which to choose of the offers made to him by Western Reserve, Johns Hopkins, and Yale. He hated to move and waited expectantly for Harvard to

> come up with something worthwhile, but Harvard slumbered on, and in the end he returned to his alma mater. As one wag put it, "Harvard fumbled the ball, and Yale fell on it."[63]

Yale was helped to some degree by two factors. First, John Fulton, and private correspondence[64] indicate that the Boston investment firm with whom Cushing entrusted his finances went bankrupt, losing great sums of money for many in the Harvard faculty. Cushing wrote to Mr. J.R. Angell, President of Yale at the time: "I now learn that the people who had my affairs in hand have so manhandled them that I may have to start in afresh as a wage earner, which is not easy at my time of life..."[65] Secondly, when Cushing respectfully declined the offer to succeed William Welch as the Professor of the History of Medicine at Johns Hopkins in 1931, he suggested the position be offered to Professor Henry Sigerist, Director of the Institute of Medical History at Leipzig. Hopkins acted upon this recommendation, and therefore, in the interval before Cushing's formal retirement from Harvard and Cutler's subsequent abuse, the position had been filled.

Still, Harvey Cushing maintained strong ties to his alma mater throughout his career, and with John Fulton successfully fueling the flames at Yale, in 1933 Cushing agreed to come on staff as the Sterling Professor of Medicine in Neurology, continue his research pursuits, and spend the dusk of his career with Yale's History of Medicine Department sharing his impressive collection of books and manuscripts.

Midnight Thinking: Harvey Cushing Brings an Unexpected Legacy to Yale

The best place to see a pathologist is in the basement of a medical school. There, where the walls sweat and trickle, where whispers echo through uncarpeted tunnels, and where great pipes course along the ceiling carrying God-knows-what effluent from the premises. Among the dews and damps, he nethers, shouldering from tank to slab and back again, his eyes hooded, and always in hand a bottle or tray the contents of which are best left unspecified. Where he passes, a chill gathers; you catch the rank whiff of formaldehyde. Should such a man smile at you, be on guard. His grin may be no impulse toward congeniality but a crafty device to lay hold of some part of you upon which his acquisitive eye has fastened.

Richard Selzer, *Confessions of a Knife*

A complete misunderstanding provided the impetus for the formal organization of Harvey Cushing's personal collection of human tumor and brain specimens, microscopic slides, patient records, and photographs, already so carefully documented and classified by Cushing, Eisenhardt, and Bailey. In the letter below from S. Burt Wolbach, pathologist at the Peter Bent Brigham Hospital (dated April 8, 1932, Dr. Cushing's 63rd birthday), he exclaims, "A chance remark dropped by Dr. Elliot Cutler yesterday to the effect that you contemplated destroying your collection of brains quite horrified me." Wolbach suggests alternative fates for the archive, specifically that the entire collection be preserved in "cold storage" in the Warren Museum; or that, at the very least, they select representative specimens for display (with the corresponding photographs and photomicrographs) as "The Cushing Collection" in the Museum.

The circumstances surrounding Cushing's dismal retirement make it conceivable that such a statement about destroying the collection *had* been made to Dr. Cutler, probably with the intent of mild derision. It is well known that while Welch and McCallum, pathologists at the Johns Hopkins Hospital maintained enthusiasm about Cushing's "private" collection, W.T. Councilman and Wolbach (his successor at Harvard's pathology department) had not always been so appreciative. Fulton suggests that the establishment of an autonomous neuropathological laboratory headed by Percival Bailey contributed to ill-feelings. Certainly the publication of the glioma monograph from the department of surgery, with nary a mention of Harvard's department of pathology made matters worse.[66] As a sort of compromise, Cushing's lab sectioned specimens for study, providing tissues first and

foremost to the pathology department. Cushing himself sectioned the gross tissues, and dictated the findings to pathology. Separate microscopic dictations and diagnoses were made by each of the laboratories, and in difficult or obscure cases, the departments conferred on findings. In each case, Cushing provided the pathology department with photographs of patients, gross specimens, and photomicrographs when they were available.[67]

DEPARTMENT OF PATHOLOGY
HARVARD MEDICAL SCHOOL
240 LONGWOOD AVENUE

Boston, Mass., April 8, 1932. ..193

Dr. Harvey Cushing,
Peter Bent Brigham Hospital,
Boston, Mass.

Dear Harvey:

A chance remark dropped by Dr. Elliot Cutler yesterday to the effect that you contemplated destroying your collection of brains quite horrified me. I have two propositions to make, one, that they be placed in cold storage in the Warren Museum, or, in case that does not seem worth while in your judgment, two, that you permit Dr. Canavan and myself with the aid of anyone you may suggest to go over the material that you are willing to discard and let us select specimens for mounting and display. What I should really like to do would be to clear a sufficient section of the Museum and to get a representative collection of brain tumors to be known as "The Cushing Collection" and to have on display with them such copies of the gross photographs and photomicrographs that are available. Whatever you do, don't destroy anything until you have given me a chance to appraise its value for the Museum, and please remember that anything that goes into the Museum will not cease to be your property.

Ever sincerely,

Burt.

SBW:W

Letter from Dr. Burt Wolbach to Dr. Harvey Cushing concerning the fate of the collection, April 8, 1932 (Cushing's birthday). From Sterling Library of Manuscripts and Archives, Yale University.

In any event, Dr. Cushing addressed Wolbach's concerns about the collection's fate. He writes the following day, perhaps with a hint of sarcasm, "Nothing under the sun would induce me to destroy the brain collection. After all, they don't belong to me, but to you, and they are merely in my hands owing to your everlasting good will and courtesy." Cushing goes on to make suggestions for providing for the archive as an organized tumor registry, which would serve as a database for scholars, and a repository for obscure specimens:

> The whole series is so carefully recorded that they ought to be of permanent value as a sort of library. Indeed, there has been a movement on foot on the part of some of the young neuro-surgoens in the country to establish a brain tumor center like the sarcoma center, to which obscure specimens might be sent and added as time goes on...

Cushing continues on to suggest that moneys be allotted for the collection to be housed in the Warren Museum, and a stipend be created to allow Dr. Eisenhardt to continue her classification and outcome research on the series.

Initially, Wolbach was able to interest D.L. Edsall, dean of Harvard Medical School, and A. Lawrence Lowell, President of the University in the project. By June of 1933, Lowell wrote a letter to Dr. Cushing, indicating all parties were anxious to see the collection permanently preserved in the Warren Museum, and implied that Cushing should pursue the project to "see how [the preservation] can be done."

Harvey Cushing labored for a year to see his registry come to fruition. The Warren Museum was in need of structural modification to accommodate the unwieldy archive at an estimated cost of $4000. James B. Conant, who succeeded Lowell as President, continued worked with Cushing on the issue, but several meetings and memos made it clear to Dr. Cushing that the momentum was draining from the project. The arduous struggle to see the Tumor Registry through to its final preservation, made impossible by Cushing's absentee status (he had already moved to New Haven by November of 1933) led him to the conclusion that he should move the entire collection to New Haven. Medical School Dean Milton Winternitz was still enthusiastic to help Dr. Cushing with his continuing endeavors. Apparently Winternitz, a pathologist by specialty, had designs on more than just Cushing's collection of books.

Following the June 27, 1934 letter from President Conant at Harvard, Dr. Cushing urged Dr. Eisenhardt to accompany the Tumor Registry to Yale, which she did in September of 1934. Owing to the generous endowment by the Bolton Fund

In any event, Dr. Cushing addressed Wolbach's concern about the collection's fate. He wrote the following day, perhaps with a hint of sarcasm: "Nothing under the sun would induce me to disrupt the brain collection. After all, they don't belong to me, but to you, and they are merely in my hands owing to your everlasting good will and courage." Cushing goes on to make suggestions for providing for the archive as an organized tumor registry, which would serve as a database for scholars, and a repository for tumors specimens.

> The whole series is so carefully recorded that they ought to be of permanent value as a sort of library. Indeed, there has been a movement on foot on the part of some of the young neurosurgeons in the country to establish a tumor center like the surgical registry of bone tumors where specimens might be sent and studied as time goes on.

Cushing continues on to suggest that money be allotted for the collection to be housed in the Warren Museum, and a stipend be created to allow Dr. Eisenhardt to continue her classification and outcome research on the series.

Initially, Wolbach was able to interest Dr. Edsall, dean of Harvard Medical School, and A. Lawrence Lowell, President of the University, in this project. In June of 1930, Lowell wrote a letter to Dr. Cushing, indicating all parties were anxious to see the collection permanently preserved in the Warren Museum, and implied that Cushing should pursue the project to "see that (the proper catalogue) be done."

Harvey Cushing labored for a long time to see his project come to fruition. The Warren Museum was in need of structural modification to accommodate the unwieldy archive of an estimated 2000 or so brains. James B. Conant, who succeeded Lowell as President, continued contact with Cushing on the issue, but several meetings and memos made it clear to Dr. Cushing that the committee was drifting from the project. The arduous struggle to see the Tumor Registry through to its final preservation, made immeasurably by Cushing's [illegible] and already moved to New Haven by November of 1933 [illegible] to his conclusion that he should move the entire collection to New Haven. [illegible] Milton Winternitz was still enthusiastic to help Dr. Cushing with his continuing endeavors. Apparently Winternitz, a pathologist by specialty, had designs on more than just Cushing's collection of books.

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and the Childs Fund, Cushing had photographed onto microfilm the entire set of records from his surgical series at the Peter Bent Brigham, and several hundred other records brought for "special purposes".

April 9, 1932

Dear Burt:

Nothing under the sun would induce me to destroy the brain collection. After all, they don't belong to me, but to you, and they are merely in my hands owing to your everlasting good will and courtesy. The whole series is so carefully recorded that they ought to be of permanent value as a sort of library. Indeed, there has been a movement on foot on the part of some of the young neuro-surgeons in the country to establish a brain tumor center like the sarcoma center, to which obscure specimens might be sent and added as time goes on, and there has even been a suggestion that a fund be raised which might justify giving Dr. Eisenhardt the opportunity of keeping on with her elaborate system of recording and classifying and reclassifying the material.

Their transfer to the Warren Museum might be just the thing, but there would be a year's work ahead going over them and cataloging and classifying them. Gross photographs of all the tumors are on the histories and on your records also, and photo-micrographs of most of them.

We'll talk it over some day.

Always yours,

Dr. S. B. Wolbach
H. M. S.

Cushing's response to Wolbach's concerns, April 9, 1932. From Sterling Library of Manuscripts and Archives, Yale University.

HARVARD UNIVERSITY
CAMBRIDGE

PRESIDENT'S OFFICE

June 16, 1933

Dear Dr Cushing:

Since I talked with you, I have communicated with Dr Wolbach and Dr Edsall about the brain tumors, and both of them feel that the collection ought to be preserved and maintained, and the place to do it is in the Warren Museum. They are anxious, therefore, to see how this can be done.

Yours very sincerely,

A. Lawrence Lowell

Dr Harvey Cushing
721 Huntington Avenue
Boston, Massachusetts

A.L. Lowell, President of Harvard University supports plans for the Registry, June 16, 1933. From Sterling Library of Manuscripts and Archives, Yale University.

6 June 1934.

Dear Louise:

Could you take a yardstick and give me an idea of the floor space that the collection of tumors covers in the basement, and how high the shelves go, so that we can get some idea of the cubic space the collection occupies? I am trying to get some idea as to where the things might be put here. Both Dr. Winternitz and Dr. Hussey are eager to have it come down here if it can be arranged and I have just had a letter from Dr. Wolbach in which he says he is doing his best to promote the project but the Department (the Pathological Department, I presume he means) has no space and the Museum has no funds to make the alterations. He proposes to get Cutler, Putnam, Stanley Cobb and Ayer to raise funds for the purpose. This I wouldn't possibly approve of.

Do let me know pronto what was the outcome of your interview with him. He tells me under date of May 29th that he has gone over the museum space and was convinced that adequate arrangements for the registry could be made at much smaller expense, he thinks about $2,000. The actual estimate of the Maintenance Department for constructing the two rooms with benches, plumbing, lighting, and so forth was a little under $4,000. "The plans were made from specifications emanating from the collaboration of Dr. Canavan and Dr. Eisenhardt." Does this mean that you and Dr. Canavan originally agreed that the top floor space for the registry was the proper one? I had always visualized the space on the same floor where her office and workroom now are: namely, on the corner of that floor as you turn to the left as you come up the stairs, beyond her room. Still, the more I have come to think about it, the more I think even that is an inadequate place for you.

Always yours,

Dr. Louise Eisenhardt
Peter Bent Brigham Hospital,
Boston, Massachusetts.

Cushing and Eisenhardt begin to make plans for the relocation of the Brain Tumor Registry. June 6, 1934. From the Sterling Library of Manuscripts and Archives, Yale University.

Concerning a Registry of Brain Tumors.

The collection of some two thousand brain tumors made by the undersigned during his period of service at the Johns Hopkins Hospital and the Peter Bent Brigham Hospital has been brought to the Yale Medical School and put under the direction of Dr. Louise Eisenhardt.

It is hoped that this collection will not only be added to from many sources, but it is intended that it should be thrown open to anyone who may be interested in the subject.

There are an immense number of problems relating to tumor classification and expectency of life after tumor removal that are as yet unsolved. Hence this collection of tumors made over a period of thirty years would be useful for those who may encounter rare tumors that they wish to have, if possible, identified and concerning which they may wish further information.

Anyone who may wish to utilize the material for this purpose or a general study of tumor types or for the preparation of papers they may have in hand will be welcome. The disposition of the material has been put in the hands of the following board of directors, a number of whom have already made use of the material and all of whom are more or less familiar with it.

Percival Bailey
F. C. Grant
S. C. Harvey
G. J. Heuer
Wilder Penfield
T. J. Putnam
Ernest Sachs
W. P. Van Wagenen

Harvey Cushing, M.D.

Bulletin announcing the Cushing Tumor Registry at Yale University. From Sterling Library of Manuscripts and Archives, Yale University.

[illegible]

Bulletin announcing the Cushing Tumor Registry at Yale University. From Sterling Library of Manuscripts and Archives, Yale University.

The Registry was comfortably arranged in the Brady Museum at the Yale School of Medicine, and Dr. Eisenhardt, appointed director of the collection, given ample laboratory space in Yale's Lauder Hall. Cushing and Eisenhardt drafted a bulletin which ran in scientific journals under the heading "Concerning a Registry of Brain Tumors". The bulletin extends invitation to anyone interested in the subject of brain tumors to contribute to or "...utilize the material for...a general study of tumor types or for the preparation of papers they may have in hand...", it makes reference to "...an immense number of problems relating to tumor classification and expectancy of life after tumor removal that are as yet unsolved...".

The photography onto microfilm was completed in 1935, and immediately, Cushing and Eisenhardt set to work on the final monograph in Cushing's trilogy on intracranial tumor growths: *The Meningiomas.* Eisenhardt continued her work with the patient follow-up, as over 1000 patients were still living at the time of Dr. Cushing's retirement. She hoped one day to publish a final report on all of Harvey Cushing's cases. (This was truly an impossible task for Dr. Eisenhardt, as of the writing of this thesis, at least three of Harvey Cushing's patients are still living.)

Work on the monograph proceeded slowly, as scholars and visitors flocked to the archive almost immediately. Hugh Cairns, the British assistant resident who worked with Cushing during the year that electrocautery was introduced to the specialty, came to New Haven in October of 1935 with the idea of publishing on the series of patients in which he saw with Cushing between September of 1926 and September of 1927. The results of his follow-up appeared in the *Yale Journal of Biology and Medicine* in 1936 under the title "The Ultimate Results of Operations for Intracranial Tumors". Cairns found that during the period, 369 patients had been admitted to the Brigham with symptoms suggestive of a brain tumor. Of those, 157 patients were found to have a verified brain tumor at autopsy or operation. Cushing and Cairns lost 22 patients to postoperative complications, and the remaining of the 135 who were discharged alive, 63 were still living 10 years later at the time of the report--37 of whom were still wage earners.[68 69] Indeed, at the writing of this thesis, one patient from Cairns study, Clarice R. (who would receive another operation in 1928 after Cairns left Cushing's service), was still living at 99 years of age--70 years after her first surgery with Dr. Cushing.

Despite his declining health, Dr. Cushing managed to labor diligently on the Meningioma monograph, which was eventually published in 1938. The monograph represents his *coup de maitre*--the final entry of his truly prolific career. Beginning

with his first paper in 1898 at Johns Hopkins to the *Meningiomas*, Harvey Cushing published 14 books and monographs, over 300 journal articles, and had been awarded the Pulitzer Prize. The bibliography represents an impressive feat in and of itself, but must be considered magnanimous when one stops to consider the clinical responsibility Cushing maintained in tandem. Albert W. Diddle, a Yale School of Medicine alumnus who has given generously to the restoration of the Cushing's Brain Tumor Registry wrote of Dr. Cushing's condition toward the end of his career:

> Eventually Dr. Cushing developed circulatory insufficiency in his lower extremities. He could walk only a few steps at a time. He came to the emergency room each working day in a car. He got out of the car and seated himself in a wheel chair and was wheeled to his office. Eventually Dr. Oughterson did a pelvic sympathectomy to try and provide relief. Postoperatively Dr. Cushing was a difficult patient. He was fearful of becoming a morphine addict when the drug was offered to relieve his pain. Dr. Cushing had the greatest charisma of any physician I have ever known. His case studies were presented in a way that one remembered his message.[70]

With the final monograph behind him, Cushing was left to pursue his obsession with book collecting. He had been an avid collector since his time with Osler and his 1900 year abroad in Europe. From that time on, Cushing stole from his work, research, and family to obtain and peruse rare books and manuscripts. His personal passion for the works of Vesalius did not limit the scope of his collection, and by the early 1930's, he boasted one of the finest personal collections of medical books in existence.

September of 1934 found Dr. Cushing en route home to New Haven from a trip to Montreal, where he visited Osler's collection of books in celebration of the opening of Wilder Penfield's Neurological Institute. On the occasion of this trip, Cushing made the decision to leave his personal library to Yale. He discussed the matter with Mrs. Cushing and sent a handwritten proposal to his colleague and fellow collector, Arnold Klebs: "I wake up in the middle of the night with the thought--why not a Klebs-Fulton-Cushing Collection so that the three could go down to bibliographic posterity hand in hand? Just imagine some young fellow long hence stumbling on our diaries and papers and correspondence about books. I envy him to think what fun he would have for I think in a certain way our three collections share a more personal and intimate provenance than has W.O.'s Library..."[71] Thus, the inertia carried from the Brain Tumor Registry (which would

soon be on its way to New Haven) perhaps fed Harvey Cushing's desire to bequeath to Yale his collection, and induce his fellow bibliophiles to do the same. Combined, the libraries formed one of the finest collections of medical historical texts, manuscripts, and incunabula in the world. Drs. Cushing, Klebs, and Fulton corresponded frequently on the matter after the initial suggestion.

The passion shared by the three men was impressive. Throughout their busy careers, they sent one another texts to review and peruse, and much of their original correspondence still remains within the leaflets and between the pages of materials. To Cushing, the collections provided some respite from his incessant operations and rounds, and his centered on the incunabula and medical historical texts. Klebs found text documenting the history of science more to his liking, and Fulton--his was a somewhat eclectic mix of the two. (Indeed, one letter written from Klebs to Fulton's wife, Lucia, suggests that she use whatever influence she may have to keep her husband interested in his experimental work "...before he plunges finally into his most beloved task of book lore.") By any measure, the three collections complemented one another quite well, and perhaps because of the rarity of the materials and sharing between the bibliophiles; redundancy was kept to a minimum.

In addition to his Pulitzer Prize winning biography of Sir William Osler, Cushing spent the latter years of his life writing and collecting essays on his experiences as a surgeon, and his opinions on medicine and medical education. *From a Surgeon's Journal*, *The Medical Career*, and Consecratio *Medici* provide clues to H.C.'s passion for his work.

Cushing maintained very specific plans for his library at Yale. He insisted that a special building be constructed which could be readily accessible to students and faculty from almost anywhere in the medical school or hospital. Eventually, Dean Winternitz and President Angell agreed to allow Grosvenor Atterbury, an undergraduate classmate and close friend of the surgeon's to begin drawing up plans for the structure. Four years of revision went into the plans. However, it soon became obvious that a totally separate structure would be prohibitively expensive. By 1938, there emerged another set of plans which described the Y-shaped building now incorporated into the medical school's Sterling Hall of Medicine. With World War II looming inevitably, concern developed over the possible dearth of raw materials for the construction.

Still, with plans seemingly secure, Cushing set back to work on his *Bio-bibliography of Andreas Vesalius*, a project which would ultimately contribute to his

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The passion shared by the three men was bibliomania. Throughout their busy careers, they sent one another books to appraise and browse, and much of their original correspondence still remained within the leaflets and between the pages of materials. To Cushing, the collections provided some respite from his incessant operations and rounds, and his interests in the incunabula and medical historical texts. Klebs found that documenting the history of printed books to his liking, and Fulton - his was a somewhat wistful bibliomania. Indeed, one letter written from Klebs to Fulton's wife, Lucia, suggests that she, the "innocent" collector she may have to keep her husband interested in his experimental work,[?] before he plunges finally into his more beloved books of more delight.[?] By any measure, the three collections complemented one another quite well, and attempts to discuss the variety of the materials and sharing between the bibliophiles led to a desire to house them in a residence.

In addition to his Fulton's persistently increasing of his historical library, Cushing spent the latter years of his life writing and continuing to work on his experiences as a surgeon, and his subsequent war and his published collection From a Surgeon's Journal. The Harvey Cushing and Cushing's library provide them an H.C.'s passion for his work.

Cushing maintained very specific plans for the building at Yale. He insisted that a special building be constructed which could be used by research students and faculty from almost anywhere in the medical school as a space. Eventually, Dean Winternitz and President Angell agreed to allow space for Anatomy, on undergraduate classrooms and close ties of the architects involved in drawing up plans for the structure. Four years of discussion went into the library. However, it soon became obvious that a totally separate building would be prohibitively expensive. By 1938, three enlarged wings had been planned, and a Y-shaped building now incorporated into the medical school's Sterling Hall of Medicine. With World War II looming overhead, concern developed over the possible dearth of raw materials for the construction.

Still, with plans seemingly secure, Cushing set back to work on his *Bio-bibliography of Andreas Vesalius*, a project which would ultimately constitute all his

end. On October 3, 1939, Cushing received word that the Sterling trustees appropriated adequate funds, the Yale Corporation accepted the plans, and work was to begin on the library. Four days later, Dr. Cushing suffered a fatal myocardial infarction precipitated by the lifting of one of the great Vesalian folios to be used in the biography.[72]

Ironically, the Brain Tumor Registry stayed at Yale in part *because* of Cushing's death. Prior to Cushing's retirement from the Brigham, Percival Bailey left for the University of Illinois to assume a position in neurology with Dr. Eric Oldberg. Since April of 1938, after the completion of the meningioma monograph and fully absorbed in his historical scholarship, Cushing had no intentions of proceeding with the scientific classifications. It is a little known fact that Cushing, Eisenhardt, Oldberg and Bailey were in accord on the theory that the entire Registry should be moved *again*, this time to Chicago, where Bailey and Eisenhardt could continue the work on problems not yet addressed. However, upon Harvey Cushing's death, Howard M. Hannah of Cleveland (who's only son succumbed to a neurological tumor) richly endowed the Brain Tumor Registry with a grant to Yale. The gift lifted Cushing's collection to the status he felt it deserved. Louise Eisenhardt and the Registry would stay in New Haven.

For two decades, Yale's Brain Tumor Registry, with Louise Eisenhardt at the helm remained a site of pilgrimage for young neurosurgeons and neuropathologists to study intracranial pathologies. She served as the Secretary-Treasurer for the Harvey Cushing Society from 1934 to 1938, then held the job of President in during 1938-39, returning to the Secretary-Treasurer position until 1952. By November of 1943, Dr. Eisenhardt became the foremost authority on brain tumors, and when the Harvey Cushing Society (now the American Association of Neurological Surgeons) founded the *Journal of Neurosurgery*, she was selected to be the editor. Eisenhardt held this post for 21 years, all the while serving as archivist and curator of the Registry. Toward the end of her career at Yale, Eisenhardt fostered her own interest in the history of medicine, acting as the Historian of the Society from 1952 until two years before her death in 1967.[73]

Oldberg

UNIVERSITY OF ILLINOIS
COLLEGE OF MEDICINE
1853 WEST POLK STREET
CHICAGO, ILLINOIS

DEPARTMENT OF NEUROLOGY AND
NEUROLOGICAL SURGERY

April 12, 1938

Dear Dr. Cushing:

Bailey and I are tremendously interested in the possibility of having the Cushing Tumor Registry. I shall be seeing Louise in about ten days and shall find out from her more of the details. In the meantime, you may rest assured that we shall bend every effort to acquire it if that turns out to be possible. As I have told you previously, our Institute is not to open until the fall of 193[illegible] and that still gives us considerable time to make arrangements. We shall keep in touch with you.

Affectionately, as ever,

Eric

Dr. Harvey Cushing
Yale School of Medicine
New Haven, Connecticut

Letter from Dr. Eric Oldberg at the University of Illinois to Dr. Cushing indicating the two were in collusion on a plan to move the Cushing Tumor Registry to Chicago. From Sterling Library of Manuscripts and Archives, Yale University.

Dr. Elias Manuelidis became Eisenhardt's successor in the Section of Neruopathology, and therefore curator of the enormous archive. The Registry had been enormously popular from 1935, probably reaching its apogee a decade later. Throughout the 40's and 50's, many young scholars, particularly neurosurgeons and neuropathologists studying for their certification boards came to utilize the collection. However, incrementally the gross specimens and photographic negatives came to be used little for research purposes. By 1968, the year after Eisenhardt's death, Manuelides faced a tremendous problem: the Section of Neruopathology prepared to secede from Pathology. With the split, laboratory space would be dearth, and the vast bookshelves, stacked floor to ceiling with gallon vesicles containing gross brain specimens and stacks of photographic negatives played little role in the developing atmosphere of bench scientific research techniques.

Manuelidis faced a genuine quagmire: the 40-year-old specimens stood in a void--too old to be of scientific value, and ironically, too young to be of historical interest. Coincidentally, the unwieldy archive reeked of formaldehyde. In a moment of genius, Dr. Manuelidis found the solution. The Edward S. Harkness Medical School Dormitory at Yale, built in 1955, retained rooms in the sub-basement for storage, adjacent to the fallout shelter. Many of the storage cages contained provisions: large barrel tins of meal, drinking water, and sanitary supplies, others were utilized for the cold storage of building supplies, file cabinets, and discarded medical equipment. Manuelidis acquired permission to stow the entire collection--photographic negatives, gross specimens, laboratory materials and dyes, even an old gurney into a locked room near the shelter. He employed the help of faculty and students, and moved everything save the microscopic slides (which are still in use today) below the dormitory.

Dr. Manuelidis may have relied on the Yale System to ensure that the archive could never be totally lost. "The System" as it is colloquially known around the campus, eliminated mandatory examinations, grades, and other forms of evaluation that could artificially create competition between the medical students. It remains a paradigm designed to give students the freedom to pursue research and clinical interests while they complete the more mundane basic science years of their medical education. Students are encouraged to spend time involved with community activities, with clinics and preceptors who catch their interest, and to foster the characteristics that made them diverse and interesting candidates. "The System" implicitly also frees time for the students to explore--perhaps the fact that

Dr. Manuelidis appreciated more than anyone. He must have counted on the fact that an enormous historical collection of human brain specimens and photographs, dating to the turn of the century, would be too great a temptation for medical students to avoid. Rumors of the Registry's existence became part of the lore of Yale's School of Medicine, and trickled through members of each class, year by year. The collection has received many visitors over the past three decades and no doubt been witness to many a bizarre ritual--all the while remaining surprisingly intact. Nearly a century after the first specimens were collected and archived, history has leant Cushing's Tumor Registry the patina it required to be re-evaluated for its scientific, ideological, and historic value.

Finding Archimedes Lever: Scientific Observation and the Significance of Harvey Cushing's Legacy at Yale

Truth emerges more readily from error than from confusion.
Francis Bacon

The Harvey Cushing Brain Tumor Registry became the object of a great amount of attention at the Yale School of Medicine. Perhaps owing to the age of the specimens and photographic negatives, the sub-basement at Harkness Hall gradually received a myriad of visitors. Indeed, the greater portion of matriculating classes were made privy to the whereabouts of the collection by 1994, bringing the collection more to the attention of the medical school community. There had been a movement on the part of the Sections of Neurosurgery and Neuropathology to refurbish and re-evaluate the aging archive, but the contemporary research climate made grant moneys difficult to obtain, especially for historical inquiries.

Then, in February of 1994, Robert Gifford, Associate Dean for Student Affairs at the Medical School received a call from Dr. Howard Spiro, a noted clinical gastroenterologist, and the Director for the Program for the Humanities in Medicine at Yale. Spiro sent on to Dr. Gifford a generous check, donated to the medical school by Dr. Albert W. Diddle, an alumnus of the school. It seems that Dr. Diddle, urgently in need of financial assistance while a medical student, received a sum of money in return for several projects he had completed to benefit the medical school. He wished to return the favor by donating money to Yale with the stipulation that it be given to a student willing to contribute a substantial portion of time working on a project to directly benefit the institution. Dr. Gifford, aware of the enthusiasm building for Cushing's Tumor Registry, consulted Dr. Dennis Spencer, Chairman of the Section of Neurosurgery with the idea that the funds might be appropriated to a student already expressing an interest in pursing his thesis on the archive. A few faculty members at Yale and other institutions across the country expressed concerns about the future scientific or historical utility of the aged archive. To these, Dr. Spencer replied, "To a neurosurgeon, this is like finding Archemides lever...If you found it, you wouldn't necessarily use it to *lift* anything, but you certainly wouldn't discard it."




The sub-basement of the E.S. Harkness Medical Student Dormitory, 1994. Photos courtesy of Terry Dagradi, Biomedical Comunications, Yale University.




Brain specimens and photographic negatives inside "the Brain Room", E.S. Harkness Medical Student Dormitory, Yale University. Photos courtesy of Terry Dagradi, Biomedical Communications, Yale University.

Dr. Gifford wrote to Albert Diddle, who welcomed the idea with enthusiasm. The alumnus reminisced about his time at Yale School of Medicine when Dr. Cushing served on the faculty: "Dr. Cushing had the greatest charisma of any physician I have ever known." Albert Diddle's gift, with supplemental grants from the National Institutes of Health and a James G. Hirsch, M.D. Endowed Medical Student Research Fellowship, provided funds for a research year to complete a thesis, and break ground on the restoration of the Harvey Cushing Brain Tumor Registry.

Aside from its inherent historical, almost sentimental value to neurosurgeons and neuropathologists, little was known about the worth of Cushing's legacy. Clearly an historical document chronicling the emergence of neurological surgery and much of neuropathology is of pertinent interest to physicians and historians, but Cushing through his own prolific writing, and Fulton by the measure of his exhaustive 754-page biography of the surgeon already shouldered the brunt of this narrative.

Harvey Cushing's meticulous nature make the Registry somewhat of a novelty. Perhaps nowhere else can one find a single coffer which so completely documents the emergence of a medical specialty--no doubt a consequence of Cushing's overawing presence and nearly solo role in neurosurgery's overture. However, the school of careful observation in medical research had long been in place since Louis, the Paris physician who between 1820 and 1860 revolutionized medicine with his detailed approach to disease description.[74] Osler believed Louis to be the godfather of the next generation of great American physicians: Oliver Wendel Holmes, Henry Bowdich and George Shattuck to name a few. In actuality, the trend toward scientific observation evidenced itself as early as 1833 with William Beaumont's exacting research on digestion in his somewhat noncompliant subject, Alexis St. Martin. Louis's observational school merged with the German institution of laboratory investigation during the late 19th century, paving the way for the establishment of curriculums in science at Yale in 1869, then Johns Hopkins and Harvard in 1871. Russell Chittenden, who served as a major inspiration to the young Harvey Cushing, chaired the first American laboratory of physiologic chemistry (part of Yale's Sheffield Scientific School) beginning in 1882.[75] Cushing's Tumor Registry co-evolved in this atmosphere of painstaking observation. The Registry stands as a remarkably thorough example indicative of the mode of scientific research at the dawn of the twentieth century; it did not

exist at the exclusion of other clinical data sets. Few however, are preserved so completely.

Unexpectedly, the most revealing source of information related to Harvey Cushing's work lay in the 15,000 some-odd photographic negatives. Clearly, the use of photography was also not a first for Dr. Cushing. Indeed, photography itself evolved largely in conjunction with medical research. Soon after its introduction in 1839, physicians quickly embraced the daguerreotype for its detail. Photomicrographs were among the first medical photographs taken, primarily because cellular physiological and pathological techniques exceeded the abilities of illustrators to relay visual data in journals. Daguerreotypes, and other early predecessors of the photograph were used to make woodcuts for illustrations long before the photographic technique of printing onto paper existed. Much of this work is attributed to John William Draper, Paul Beck Goddard, John Locke, and Oliver Wendell Holmes (originator of the stereoscope) were among the physicians who worked to bring the photograph to clinical application.[76]

Illustration to correlate morphology with psychopathology existed in the early part of the 19th century, and psychiatrists embraced the photographic method quite early on. Ironically, by 1843-44, a Dr. Thomas Storey Kirkbride utilized some of the first photographic slides in his practice not for the study of his patients, but rather for their recreation: he employed "lantern slides" to combat the boredom of life in a sanitarium. Kirkbride developed a mutually beneficial relationship with Frederick and Wilhelm Langenheim, two early American photographic pioneers, whereby he financed their photographic research in trade for stereopticon slides shown to amuse his patients.[77]

Dr. Gurdon Buck, the famous orthopaedist and plastic surgeon utilized the daguerreotype as early as April of 1845. He began to image his patients post-operatively before their release from the New York Hospital. An early woodcut appeared in the *American Journal of the Medical Sciences*, which gave the classic case report describing "Buck's operation" to straighten an anchylosed leg. Dr. Buck, who served in the Civil War beginning in 1861, continued to employ photographic techniques to image his patients pre- and post-operatively. By 1876, he published a treatise on plastic and reparative surgery illustrated with engravings from these photographs.[78] As the technology was developed to produce multiple images, and images onto paper, physicians exploited photography for therapy, diagnosis, record-keeping, reportage, and personal communication

with peers in the medical field. The techniques were certainly well-in-use at Harvard and the Johns Hopkins when Cushing began his work there.

Cushing's negatives portray patients pre- and post-operatively, gross specimens, tumor specimens, photomicrographs, journal excerpts, letters, and any other number of images relating to the founding of tumor surgery on the brain. A small number of these were published with Cushing's original reports and monographs, others can be found inserted into the Peter Bent Brigham Hospital records. A great percentage, however, have never been published (if they were ever even printed), and are riveting for their subject matter. The photographs often portray obsolete surgical practices, tumors which have grown to proportions rarely seen today outside the third world, and allude to the symptomatology, signs, and diagnostic techniques employed which led Drs. Cushing, Eisenhardt, and Bailey to the foundations of modern neurosurgery and neuropathology. Approximately 80% of the negatives are etched into the emulsion of 5" x 7" glass plates, the remainder (in poorer condition) appear on 5" x 7" celluloid film. Owing to the negative's large format, the prints are striking for their clarity of detail.

Because the photographic negatives are in a chronological order which correlates with the hospital records, Cushing preserved for history a remarkable photographic and written diary of sorts. In the photographic negatives, one can follow the clinical presentation of disease as it manifest itself to Dr. Cushing. One sees the sudden emergence of changing surgical approaches, documented in the records and complemented by novel intraoperative drawings and photographs of patients with craniotomy scars indicative of a changing technique (Cushing's infamous "crossbow incision" is the classic example of this). The photographs and records hint at the neurosurgeon's morbidity and mortality, from of abscesses to gaze disturbances. In these images, radiographs evidence the emergence of the silver hemostatic clip, portraits exhibit similarities in morphology leading Cushing's elucidation of *pituitary basophilism*, and histological photomicrographs highlight the utilization of staining techniques brought to the Brigham by Percival Bailey.

The hospital records that accompany the photographs indicate that Dr. Cushing cultivated in his residents the same meticulous attention to factual detail for which he is renown. Past medical histories, family histories, complaints, progress notes, laboratory and perimetry results, neurological and physical examinations, operative notes, postmortem reports, telegrams, correspondence, and Cushing's ubiquitous operative sketches make the records so comprehensive that scientific studies of the cases, including the applications of pre-morbidity

scales, is possible. The photographic negatives and patient records tell the historian much about Cushing, indeed much about the state of clinical medicine and surgery at the Peter Bent Brigham Hospital in the early part of the twentieth century. Ironically and perhaps owing to the participation of Eisenhardt, Bailey, and various other residents, the archive seems to boast an integrity which may have been lacking from some of Cushing's scientific research.

Elizabeth Thomson, Percival Bailey, John Fulton, and Walter Dandy among others comment briefly on Dr. Cushing's faults as a researcher. He tended toward deductive reasoning in his scientific pursuits: setting forth theories, then expending enormous amounts of time and energy to prove his preconceptions. His digression from inductive reasoning would perhaps have been excusable had it not been for his stubborn demeanor--Harvey Cushing often proved unwilling to abandon his preconceptions.[79] John Fulton wrote of this weakness: "As an investigator Harvey Cushing had conspicuous faults as well as obvious virtues...In the papers on posterior pituitary secretion he had been led astray, but despite an imposing array of evidence to the contrary, he never really admitted that he had been wrong."[80]

As discussed previously, Harvey Cushing's obstinacy contributed to fiery relations between he an Percival Bailey. Bailey provides an anecdote as proof of Harvey Cushing's scientific flaws. While working in Cushing's animal surgery laboratory at Harvard, Bailey inadvertently produced a lesion to the hypothalamus during a pituitary surgery. The operation was abandoned, and the next morning, Bailey found that the dog produced vast amounts of urine overnight. This finding led Bailey and Frederic Bremer, another fellow in the laboratory to postulate that diabetes insipidus could be a neurogenic disorder. The pair worked on the thesis without the consent of Dr. Cushing, eventually proving that not only diabetes insipidus, but also the adiposogenital syndrome could be caused by hypothalamic lesions even if the pituitary was left intact. Bailey continues:

> I shall never forget the evening when Bremer and I showed [Cushing] the results. He was very upset, said it was impossible, pounded the table with his fist and forbade us to publish our results. Only when Bremer, in open-mouthed astonishment, said that he would publish them in Belgium did he quiet down and agree that we might publish the part about diabetes insipidus. This is why the adiposogenital syndrome is mentioned only in a brief summary which appeared in the journal, *Endocrinology*. We did not realize at that time that we had struck at the very basis of his scientific

reputation. It rested primarily on the production of the adiposogenital syndrome which he had attributed to the removal of the hypophysis.[81]

Cushing's lapses from scientific integrity also led to his renown feud with Walter Dandy, a research assistant at Johns Hopkins. Their differences brewed over laboratory results which Dr. Dandy found during his study on glycosurea for Cushing. He reported to Dr. Cushing that an experimental error indicated a difference between experimental and control groups, when in fact, his repeat experiments showed no difference. Cushing had been prepared to report the previous results, and forbade Dandy from mentioning the scientific facts. However, Walter Dandy proved to be equally strong-willed, opinionated, and stubborn as Dr. Cushing, and the two battled furiously for the next 27 years.

The feud seems to have been largely counterproductive. Dandy was not included with the entourage Cushing took with him to the Peter Bent Brigham in 1913. Despite this fact, he stayed on and became the resident neurosurgeon at the Johns Hopkins Hospital, earning a reputation as a more daring and radical surgeon than Cushing, who some sources agree might have actually surpassed Harvey Cushing for his surgical expertise.[82] In addition, by 1921 Dr. Dandy pioneered ventriculography--a pneumatic technique for imaging the ventricles with X-rays. Cushing almost uniformly refused to utilize the procedure (which he felt would deter from a comprehensive neurological examination), a decision which may have contributed slightly to morbidity or mortality. At least one clinic reported a 55% to 95% correct diagnosis difference before and after the advent of ventriculography.[83] Gilbert Horrax, Cushing's loyal assistant resident, wrote of ventriculography in 1942:

> The importance of this diagnostic method, not only for the localization of heretofore unlocalized brain tumors, but also for the more accurate localization of many growths whose situation could not be ascertained with absolute exactness, can hardly be overemphasized. It brought immediately into the operable field at least one third more brain tumors than could be diagnosed and localized previously by the most refined neurological methods.[84]

Dr. Richard Light, Cushing's last resident at the Brigham wrote: "One feels that Cushing's greatness in the research line is due more to his interpretation of clinical findings from his operative cases than to the experimental work in animals."[85] After 1915, Cushing shared the control and evaluation of the Brain Tumor

reputation. It rested primarily on the persistence of the symptom-complex syndrome which he had attributed to the removal of the hypophysis.[81]

Cushing's lapses from scientific integrity also led to his famous feud with Walter Dandy, a research assistant at Johns Hopkins. Their differences focused over laboratory results which Dr. Dandy found during his study on glandectomy for Cushing. He reported to Dr. Cushing that an experimental error indicated a difference between experimental and control groups, when in fact, his repeat experiments showed no difference. Cushing had been prepared to report the previous results, and forbade Dandy from mentioning the scientific facts. However, Walter Dandy proved to be equally strong-willed, opinionated, and stubborn as Dr. Cushing, and the two became enemies for the next 27 years.

The feud seems to have been largely one-directional. Dandy was not included with the entourage Cushing took with him to the Peter Bent Brigham in 1913. Despite this fact, he stayed on, and by one the resident neurosurgeon at the Johns Hopkins Hospital, earning a reputation as a more daring and radical surgeon than Cushing, who some sources agree might have actually surpassed Harvey Cushing for his surgical expertise.[82] In addition, by 1921 Dr. Dandy pioneered ventriculography--a pneumatic technique for diagnosis then considered with X-rays. Cushing almost uniformly refused to utilize the procedure, fearing he felt would deter from a comprehensive neurological examination, a practice which may have contributed slightly to morbidity or mortality. Although the technique provided a 95% to 98% correct diagnosis difference before and after the advent of ventriculography,[83] Gilbert Horrax, Cushing's loyal assistant finally accepted ventriculography in 1942:

> The importance of this diagnostic method, enabling as it does hitherto unlocalized brain tumors, and some of the most accurate localization of many growths whose accurate extent could not be determined with absolute exactness, can hardly be overemphasized. It has given a new dimension into the operable field at least one third more brain tumors that could be diagnosed and localized previously by the usual neurological examination methods.[84]

Dr. Richard Light, Cushing's last resident in the Brigham stated, "Our feeling that Cushing's greatness in the research line is due more to his interpretation of clinical findings from his operative cases than to the experimental work on animals."[85] After 1913, Cushing shared the control and evaluation of the Brain Tumor

Registry to a great degree, first with Eisenhardt, and then Bailey as well. It is conceivable that the tight surveillance over the collection, coupled with the immobility of clinical facts recorded by Dr. Cushing and the residents forced the neurosurgeon to stay on the path of inductive reasoning. Cushing's monographs and clinical journal reports bear credence to this theory.

Even prior to Eisenhardt's role, the clinical data from his collection assured Cushing's scientific progress despite his aberrant scientific theories. *The Pituitary Body and its Disorders* begins with citations of the work done by Cushing and Emil Goetsch postulating the existence of a "posterior pituitary extract". Experiments injecting powderized posterior pituitary extracts into humans and animals led Cushing and Goetsch erroneously to conclude that the CSF contained:

> [Extracts which] bear a close resemblance to those extracts of the adrenal medulla, differing from them in the primary depressor and longer pressor response of the general circulation; in the slowing of the pulse after atropin or section of the vagi; in the constriction of the coronary and dilatation of the renal vessels, andrenalin having an opposite effect; in the production of diuresis from a specific action on the renal epithelium; and in their direct action on the involuntary muscles rather than on the sympathetic nerve endings...[86]

The effectual and literal weight of the monograph seduces the reader with 47 complete case studies of patients suffering from various forms of pituitary pathology. These Cushing classified into three groups: states of relative hypophyseal overactivity, or *hyperpituitarism*; states of relative hypophyseal underactivity, or *hypopituitarism*; and clinical states in which aspects of both of the above syndromes manifest in the same patient, or *dyspituitarism*. The presentations, histories, perimetry results, and photographs presented in the monograph remain classic and comprehensive studies of hypophyseal malfunction. Even a case of *pituitary basophilism*, the "dyspituitary" syndrome Dr. Cushing would describe 20 years later, is shown to have perplexed him as early as 1910. Indeed, Harvey Cushing's clinical acumen probably contributed much more to his reputation than his scientific laboratory endeavors.

Aside from their contributions to his clinical research, the records and photographs belonging to the Cushing Tumor Registry contain detailed information which inadvertently serves to shed light on the social construct within which medicine was carried out prior to 1932. One of the many examples of this

Registry to a great degree, first with Eisenhardt, and [illegible]. It is conceivable that the tight surveillance over his [illegible] the immobility of clinical facts recorded by Dr. Cushing and [illegible] the neurosurgeon to stay on the path of inductive reasoning. Cushing's monographs and clinical journal reports bear credence to this theory.

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phenomenon lies in the case of D.A., a 14 year old girl who entered Cushing's recently established neurosurgical service in June of 1913. D.A. visited the Massachusetts General Hospital beginning in August of 1910 complaining of polyuria and a persistent headache. She reported to the M.G.H. three more times with these complaints, adding to the list vomiting, weight loss, changing vision requiring glasses, and persistent thirst. She was diagnosed with "Diabetes Insipidus", "Constipation with Obesity" (her headache subsided on one occasion after catharsis), and "Progressive emaciation, for which no disease can be found". By April of 1911, she had mydriasis of her left pupil and "swelling of both nerve heads" of the fundi. At that time, the suspicion of an intracranial neoplasm was entertained, and an added note suggested "observation considering advisability (sic) of decompression".

Eventually, D.A. was referred to Dr. Cushing, who performed a subtemporal decompression on July, 1913 with resolution of all symptoms save her polyuria and slight photophobia. D.A. remained in the hospital until August 19, 1913 owing to "poor surroundings at home".

Unfortunately, she returned to the P.B.B.H. in November of 1913 with her symptoms grossly exaggerated. Dr. Cushing immediately had her readmitted and reoperated, this time in an attempt to remove her interpeduncular pathology. In the operative note, Cushing alluded to his 1902 case of Mary Donnelly, the "lost pituitary teratoma" which justified the creation of the Tumor Registry. D.A., like Mary Donnelly became spastic, rigid, and exhibited decerebrate posturing immediately following surgery. Cushing surmised that the tumor had been pushed back in such a way as to create an internal hydrocephalus (presumably the autopsy result in M.D.) D.A.'s condition deteriorated so that Cushing reoperated again, this time without anesthesia. Dr. Cushing wrote of the procedure in his operative note:

> ...punctures were attempted at Kocher's point to relieve pressure, but only brain oozed out (in "wormlike form" with no fluid)--because I already felt the patient to be living as a decerebrate animal, I thought it justifiable to continue the operation through the frontal lobe to remove the tumor, with the expectation and hope that performance would be fatal.[87]

Cushing eventually removed the tumor, and D.A. received a transfusion in an effort to bring up her blood pressure. She suffered severe temperature, pulse and respiration fluctuations, and died at 2 p.m. in a flaccid, decerebrate state.

D.A., age 14. Photographs from the Harvey Cushing Brain Tumor Registry, Yale University.

The case is revealing in many ways. Immediately, one will appreciate the inability of clinicians in 1910 to recognize symptomatology which clearly indicated that D.A. suffered from a brain tumor. Secondly, the case presented alludes to problems in patient disposition which still exist today, exemplified by D.A.'s one month stay in the hospital after a relatively simple procedure. The first operative note provides a brilliant example of Cushing's mind for clinical comparison and correlation. He makes reference to an operation he performed 11 years previously, and characteristic of his rather didactic notes, he suggests the similarities between cases. The second operative note makes obvious how remarkably the physician's role has changed over the last 83 years. Not only does Dr. Cushing take action to euthanize his unfortunate, decerebrate patient, but he thinks nothing of revealing his intention in the operative note. By the standards of medical care today, Cushing's actions would be morally and legally indefensible; in 1913, he could act with impunity. Clearly, societal attitudes concerning euthanasia, quality of life, the role of the physician in life and death, and the legal climate have changed considerably since the opening of the Peter Bent Brigham Hospital.

Another case report illustrates the unexpected tenor of information which can be inferred from the hospital records. J.M., a 38 year old freight handler from Sommerville, Massachusetts presented to Cushing's clinic with symptoms indicative of a cerebellar tumor. He underwent a right subtemporal decompression in August of 1914, and when the symptoms failed to resolve, he returned to the operating room for a complete suboccipital exploration. By report, his demeanor changed significantly after his time at the Brigham. One evening, he returned home after drinking and threatened to murder his wife and child. The police responded to the domestic dispute, and eventually J.M. was committed to the Grafton State Hospital for mental disease. The record contains several pieces of correspondence from Mrs. M dating from 1914 to 1929. She wrote to Cushing on her husband's behalf, begging the surgeon to intervene and help her gain custody of her husband. She provided one of her husband's notes commenting on his treatment at Grafton, detailing his inhuman treatment--he was often beaten over the head with rubber keys, and forced to sleep unclothed on mattresses wetted by Grafton's employees. Cushing was unable or unwilling to involve himself in the matter, and J.M. died alone, from "brain aneurysm" at the Grafton Hospital in 1929, fifteen years after the commitment.

Aside from its historical merit, the photographic archive and hospital records give the observer a unique glimpse into the world of Dr. Cushing's patients. While nearly a century old, the photographs afford one the opportunity to witness a timeless emotional undercurrent: to briefly grasp a sentience of what it meant to be a person battling a serious neurological affliction.

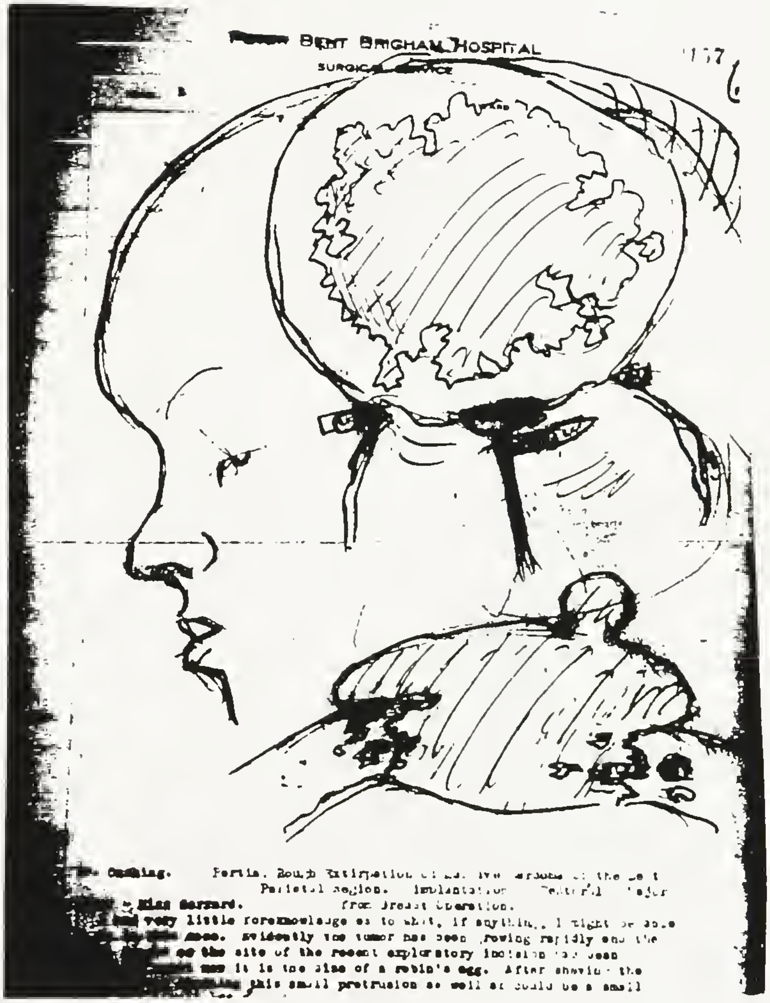
Michael Salcman, M.D., in his essay "Neurosurgery and the Surgical Art", comments on the conception of neurosurgery as an art form. Surgery, he feels, draws influence as do painting or sculpture: by the elaboration of new world views. The delineation of the Einsteinian universe where "the speed of light becomes the only reliable invariant and all events are relativistically contingent upon the speed of the observer and the nature of his frame of reference" inspires the "simultaneity of views in a cubist landscape" or "the melting clocks in a Dali". Analogously, Salcman argues that in the art of neurosurgery we find the emergence of the microscope and the stereotactic surgeon--able to think and act within several frames of reference.[88]

Salcman quotes George Sand: "...art, at its greatest, is nothing but the expression of wisdom. Wisdom teaches us to see something outside ourselves that is higher than what is within us, and gradually, through contemplation and admiration, to come to resemble it."[89] Salcman believes artists to be "the creators of artifacts, which are in themselves subject to some theoretical standard of beauty or creative significance."[90] 19th century art critic John Ruskin states: "Fine art is that in which the hand, the head, and the heart of man go together."[91]

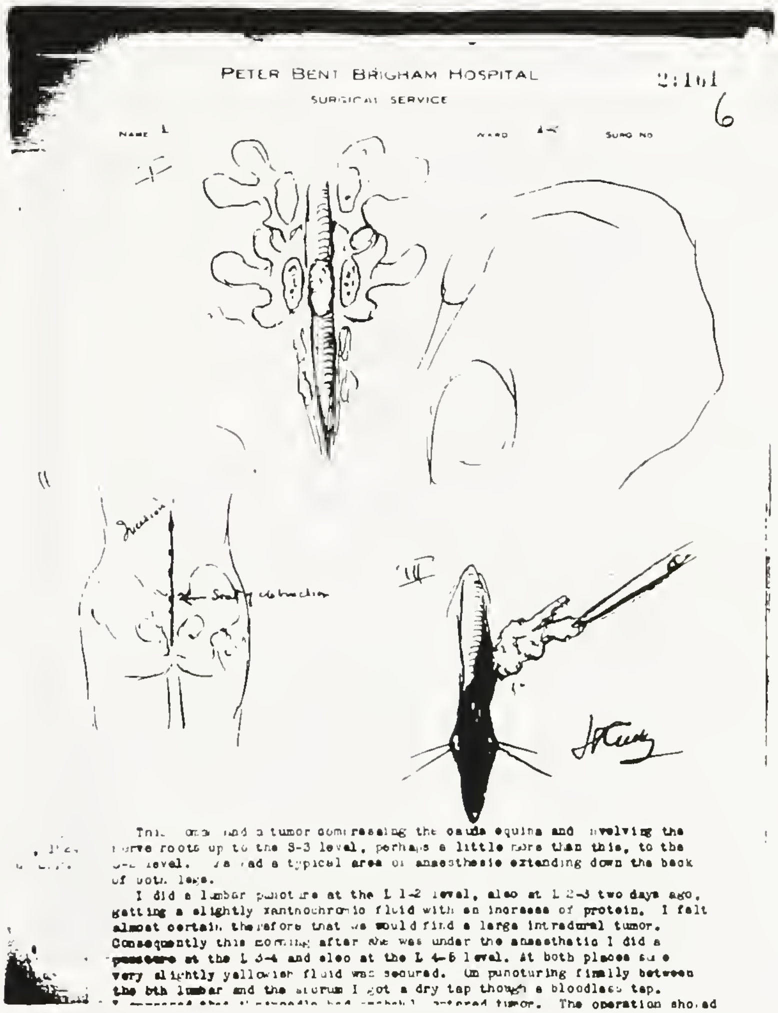
By any measure, Harvey Cushing's written and photographic diary of neurosurgery in the early part of the twentieth century steps beyond semantic issues. The technique and large format of the photographic negatives capture a raw emotional energy and oftentimes macabre subject matter which bring the viewer into empathetic participation with Dr. Cushing's patients. This relationship becomes much more sublime when one stops to consider the age of the photographs, and senses that while neurosurgery changed so much over this past century, the experience of being a patient has not. In 1969, the year Harvey Cushing would have been a centenarian, Wilder Penfield qualified him as "an artist, a Leonardo da Vinci devoting his talent to surgery."[92] The passing of time and the re-evaluation of the materials belonging to the Harvey Cushing Brain Tumor Registry buttress the veracity of Penfield's statement.

Ms. C.B., a woman with Paget's disease presents to Dr. Cushing with a fungating mass on her skull. A diagnosis is made of osteosarcoma of the skull, and Cushing operates immediately for palliation. The following pages highlight preoperative and postmortem views taken for study. From the Harvey Cushing Brain Tumor Registry, Yale University.

C.B. died four months after her initial presentation to Dr. Cushing. Near the time of her death, she returned to the P.B.B.H. of her own volition with the hope that Cushing and his colleagues might make complete studies of her illness for the benefit of future patients. She is pictured here (still living) with complete regrowth of the mass. From the Harvey Cushing Brain Tumor Registry, Yale University.



Operative sketch of C.B. by Dr. Cushing. From P.B.B.H. records, Harvey Cushing Brain Tumor Registry, Yale University.


PETER BENT BRIGHAM HOSPITAL 2:161

SURGICAL SERVICE 6

NAME L WARD SURG NO

Incision

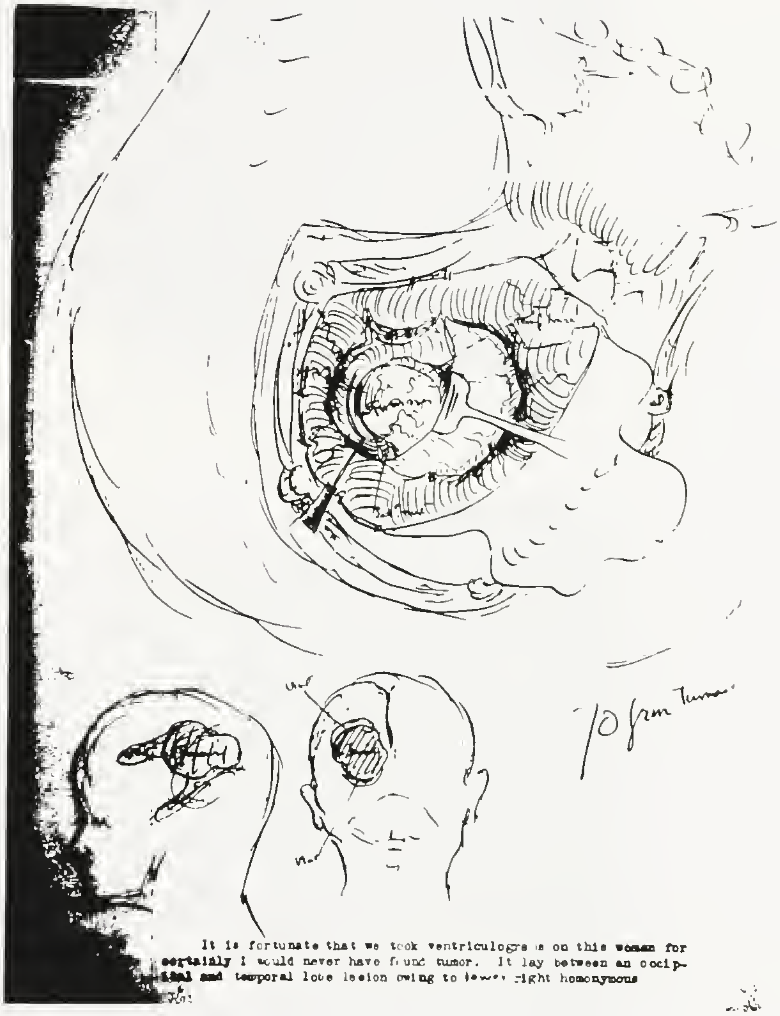
Small obstruction

III

This [illegible] had a tumor compressing the cauda equina and involving the nerve roots up to the S-3 level, perhaps a little more than this, to the [illegible] level. [illegible] had a typical area of anaesthesia extending down the back of both legs.

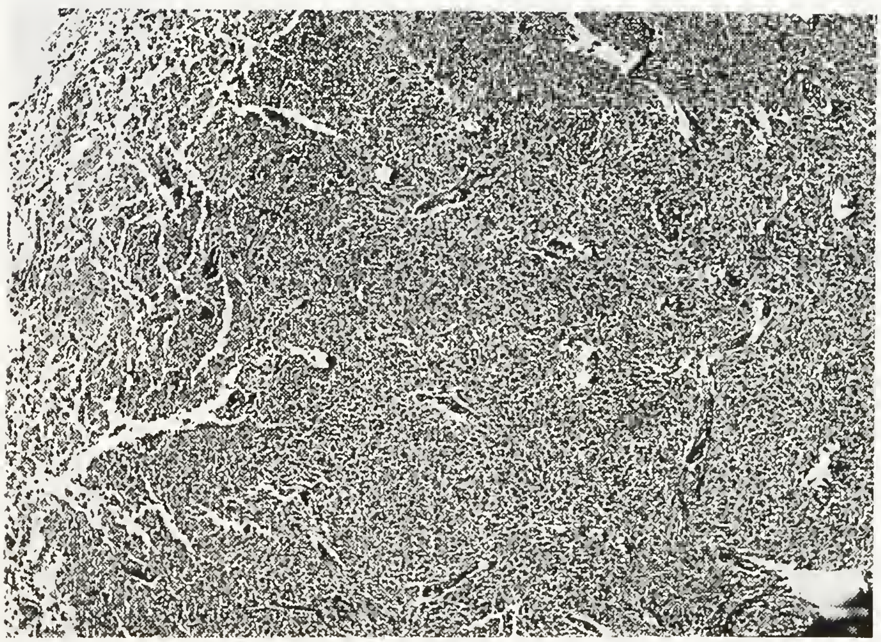
I did a lumbar puncture at the L 1-2 level, also at L 2-3 two days ago, getting a slightly xanthochromic fluid with an increase of protein. I felt almost certain therefore that we would find a large intradural tumor. Consequently this morning after she was under the anaesthetic I did a puncture at the L 3-4 and also at the L 4-5 level. At both places some very slightly yellowish fluid was secured. On puncturing finally between the 5th lumbar and the sacrum I got a dry tap though a bloodless tap. [illegible] tumor. The operation showed

Operative sketch made during removal of spinal cord tumor. Note Cushing's didactic operative note. From P.B.B.H. records, Harvey Cushing Brain Tumor Registry, Yale University.

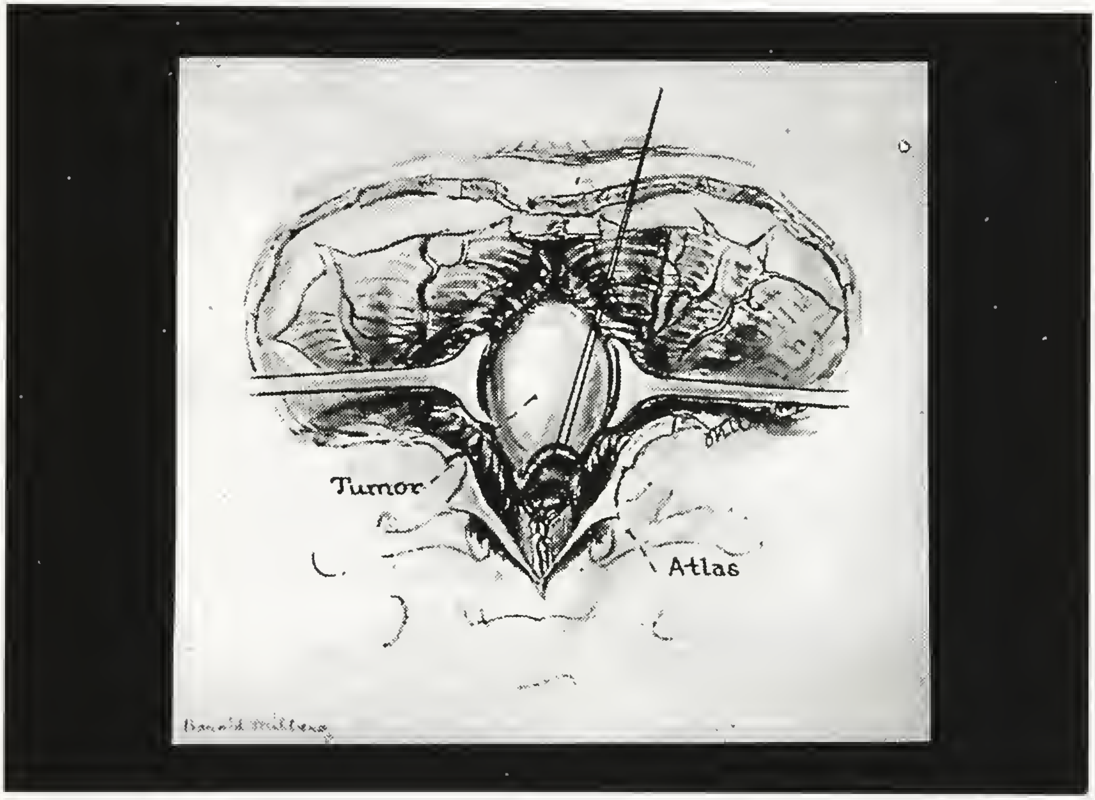


Operative sketch made by Dr. Cushing during removal of tumor. In the accompanying note, Cushing credits the utilization of ventriculography to localize the tumor. From P.B.B.H. records, Harvey Cushing Brain Tumor Registry, Yale University.

H.M., a young boy with a previous operation by Cushing for cerebellar tumor presented to Dr. Cushing a second time with a "spinal cord tumor". (Above) Postoperative photograph displaying previous "crossbow" incision at base of skull, and healing incision from spinal laminectomy. (Below) Tumor specimen removed at surgery. From the Harvey Cushing Brain Tumor Registry, Yale University.



(Above) Note from H.M.'s P.B.B.H. records with inserted histopathological photograph, 1924. (Below) Histopathological photograph. Both from the Harvey Cushing Brain Tumor Registry, Yale University.



Intraoperative drawing by Miss Warner of H.M.'s cerebellar tumor (previous operation).
From the Harvey Cushing Brain Tumor Registry, Yale University.

PETER BENT BRIGHAM HOSPITAL 205

SURGICAL SERVICE

WARD A-2 SURG. NO. 4

This was an extremely interesting case, very reminiscent of the case of Mrs. Dr. B who had an enucleable tumor, supposed at the time to be a benign tumor, removed from her left cerebellar hemisphere. She subsequently had spinal symptoms and was operated upon by Dr. Elsberg. There were repeated x-ray treatments of spine and cerebellum, (at least I think also of cerebellum). She finally died from an intracranial extension of the growth I believe and at post mortem there was not a trace to be found of a spinal cord tumor, so that the pathologist had doubts as to the correctness of Dr. Elsberg's finding although Dr. Elsberg had sections and I believe I have also sections of the tumor. These cases undoubtedly fit in with the cases of so-called sarcomatosis of the meninges and it is possible, as has been suggested by Dr. Bailey, that they may all prove to be or many of them at least prove to be neuroblastomas, or as he now prefers to call them, spongioblastomas.

This little boy some years ago I believe had a median cerebellar tumor disclosed which proved to be of this type. He has done extremely well during the interval and has returned, supposedly with a recurrence. He has since had x-ray treatments. However, there are no signs of intracranial trouble at present, no pressure symptoms, the rim of the old cerebellar defect can be palpated and there is no tension there. His paraplegia, moreover, is much more marked than would be expected from a cerebellar lesion of any kind with which I am familiar. To be sure, the sensory symptoms are very inconspicuous but there is a definite upper margin of relative sensory loss corresponding about with the 6th thoracic segment. He also had a typical Froin syndrome, the cerebrospinal fluid clotting immediately on standing. I expected that I might find more than the local lesion and of course there may be more than the lesion which was disclosed.

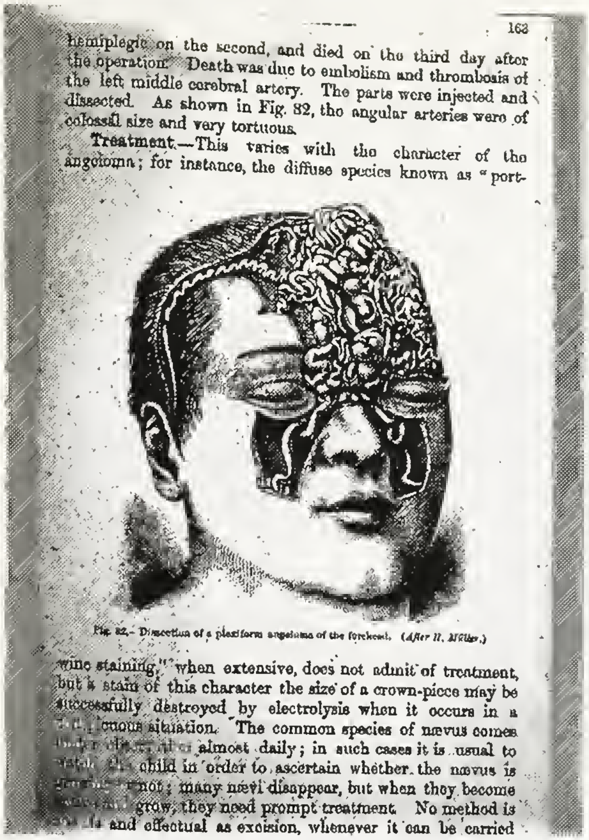
...TIVE NOTE
...25, 1924
...TOR Dr. Cushing
...HESIA. Ether - Miss Gerrard.

High Thoracic Laminectomy - Disclosure of a Cuff of Tumor Surrounding the Cord and Within the Arachnoid. Partial Removal of This Tumor. Dura Left Open.

Realising that tumors are apt to be higher than their symptoms indicate and also led by the fact that this little boy's tenderness on pressure was chiefly opposite the 3rd thoracic spine, I made a fairly high laminectomy, removing possibly the 2nd, 3rd and 4th spines. There was no difficulty in the procedure and very little bleeding. The periosteum was carefully scraped from the laminae. There was an abundance of fat and pulsating meninges so that I realised I was probably above the tumor if there actually were tumor. The dura was opened, disclosing a somewhat grayish arachnoid but no tumor but I inserted between the dura and arachnoid a ureteral bougie upward as far as the 4th ventricle without meeting resistance. On reversing this process about 4 cm. below the opening definite resistance was encountered. Consequently three more laminae were removed, I should think possibly the 4th, 5th and perhaps the 6th. The dura here was pulsating much less definitely but on opening it I came down immediately upon tumor. This consisted of a cuff of tumor slightly adherent to the dura by fine vascular adhesions about one inch in length, completely surrounding the cord in the arachnoid. Below the lower margin of the tumor was bulging the pulsating arachnoid.
... with fine sutures as retractors

Note in H.M.'s hospital chart with another of Harvey Cushing's didactic notes. From P.B.B.H. records, Harvey Cushing Brain Tumor Registry, Yale University.

Note in H.M.'s hospital chart with symbol of Harvey Cushing's didactic notes. From P.B.B.H. records, Harvey Cushing Brain Tumor Registry, Yale University.

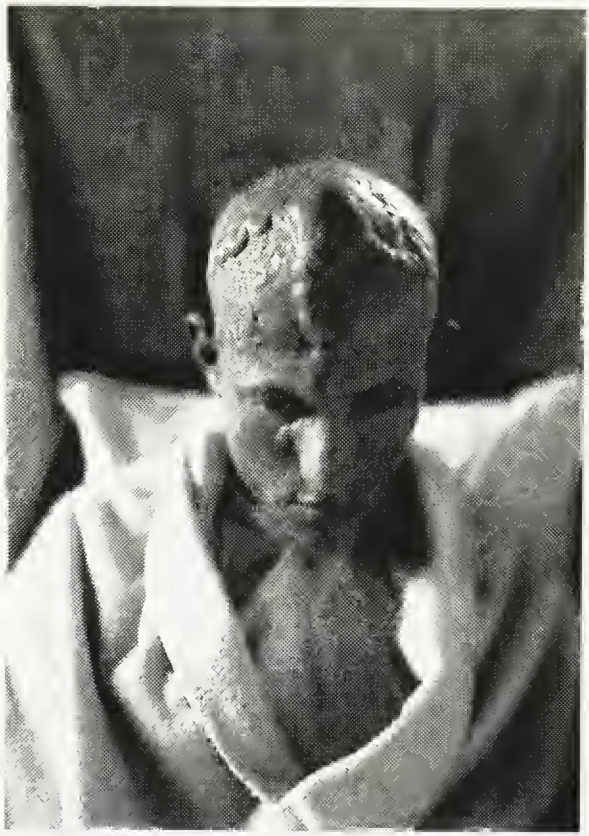

163

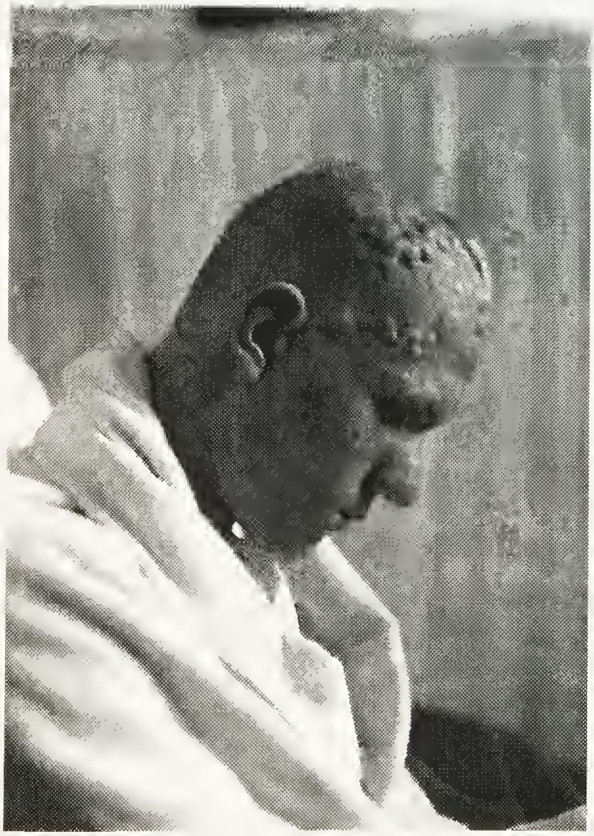
hemiplegic on the second, and died on the third day after the operation. Death was due to embolism and thrombosis of the left middle cerebral artery. The parts were injected and dissected. As shown in Fig. 82, the angular arteries were of colossal size and very tortuous.

Treatment.—This varies with the character of the angeioma; for instance, the diffuse species known as "port-

Fig. 82.—Dissection of a plexiform angeioma of the forehead. (*After H. Müller.*)

wine staining," when extensive, does not admit of treatment, but a stain of this character the size of a crown-piece may be successfully destroyed by electrolysis when it occurs in a [illegible] cuous situation. The common species of nævus comes [illegible] almost daily; in such cases it is usual to [illegible] child in order to ascertain whether the nævus is [illegible] not; many nævi disappear, but when they become [illegible] grow, they need prompt treatment. No method is [illegible] and effectual as excision, whenever it can be carried





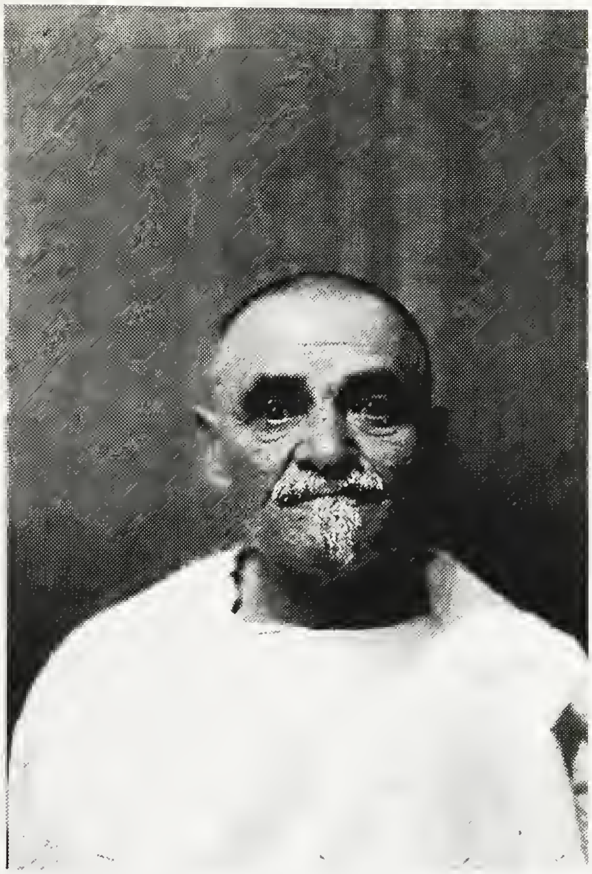
(Above left) Journal article copy utilized for H.C. aneurism paper. (Above right, Below left) Preoperative photographs of J.A., with "cirsoid aneurism". (Below right) Postoperative photo of J.A., 1922. From the Harvey Cushing Brain Tumor Registry, Yale University.

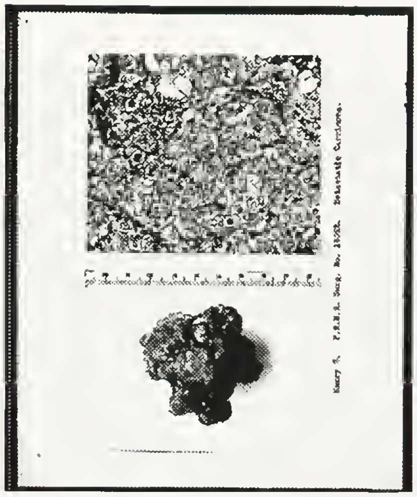
Mr. P., pituitary adenoma. (Left) preoperative photograph. (Right) postoperative photograph. From the Harvey Cushing Brain Tumor Registry, Yale University.

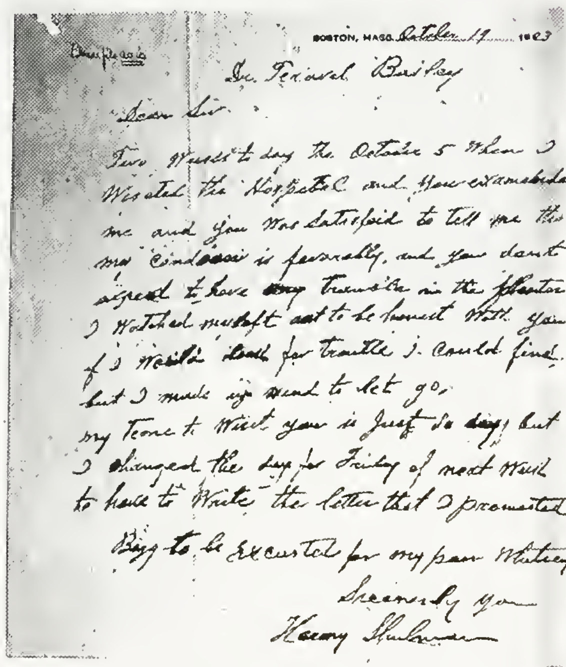
Mr F., pituitary adenoma. (Left) preoperative [illegible]
Photograph. From the Harvey Cushing Brain Tumor Registry, [illegible]

(Above left) A.B., Frolich's syndrome with "hereditary tendencies". Pictured with P.B.B.H. nurse, 1913. (Above right) A.B. with relative, 1913. (Below) Composite photograph/lantern slide of A.B. shows preoperative photographs, hand and skull X-rays, and perimetry studies, 1913. From the Harvey Cushing Brain Tumor Registry, Yale University.

(Above left) A.H., Fröhlich's syndrome with "hereditary syndactyly". Followed with F... series, 1918. (Above right) A.H. with relative, 1932. (Below) Composite photograph/lantern slide of A.H. shows preoperative photographs, hand and skull x-rays and perimetry studies, 1918. From the Harvey Cushing Brain Tumor Registry, Yale University.







BOSTON, MASS. October 19 1923

Dr. Percival Bailey

Dear Sir

Two Weeks to day the October 5 When I
Wisited the Hospital and You examinated
me and You Was satisfaid to tell me that
my [illegible] is favorably, and You dont
aspect to have any trouble in the [illegible]
I Watched myself not to be honest With You
if I Would look for trouble I Could find
but I made my mind to let go.
my Time to Wisit You is Just [illegible] day, but
I changed the day for Friday of next Week
to have to Write the letter that I promested

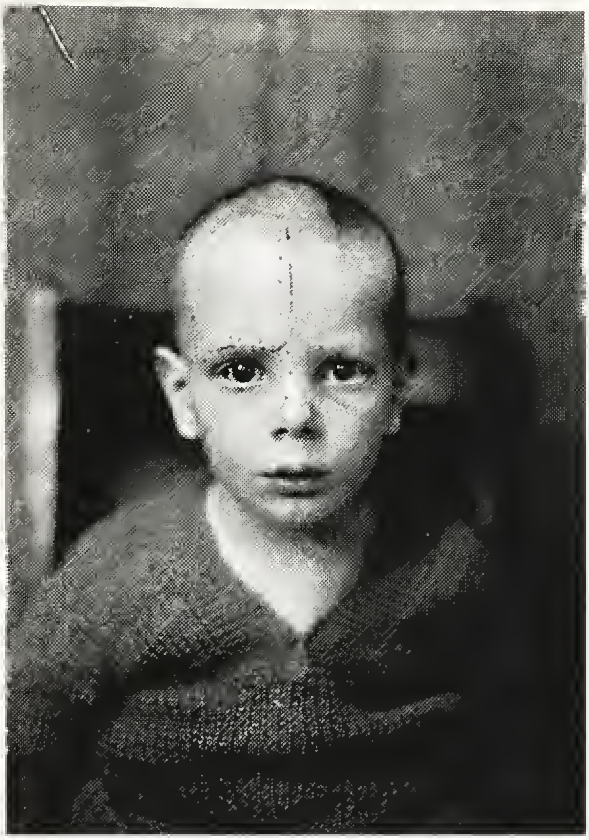
Beg to be Excused for my poor Writing

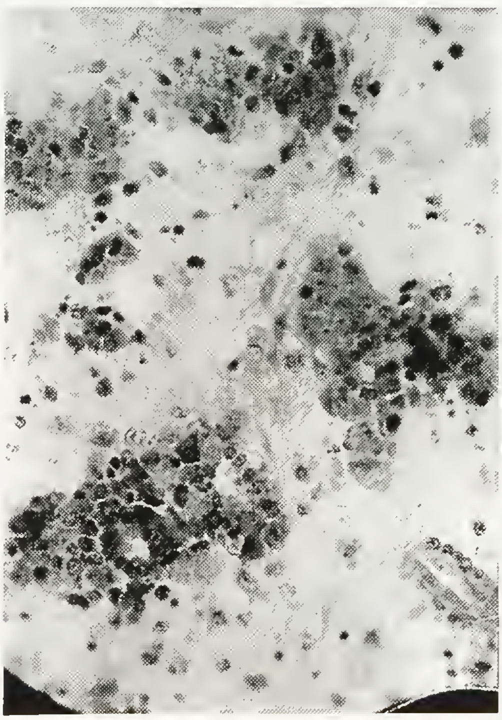
Sincerely you
Harry [illegible]

H.S., "metastatic carcinoma", 1923. (Above left) Postoperative photograph. (Above right) Lantern slide of gross and microscopic specimens. (Below) Letter of October 1923. H.S. presented with a written aphagia preoperatively; Cushing, Eisenhardt and Bailey charted his postoperative progress with frequent examinations and written letters. From the Harvey Cushing Brain Tumor Registry, Yale University.

H.S., "melanotic carcinoma", 1928. (Above left) Preoperative photograph. (Above right) Lantern slide of gross and microscopic specimens. (Below) Letter of October 1929. H.S. presented with a written epileptic autobiography, Cushing, Eisenhardt and Rider charted his postoperative progress with frequent recordings and written letters. From the Harvey Cushing Brain Tumor Registry, Yale University.

H.M., preoperative photographs taken April, 1923. From the Harvey Cushing Brain Tumor Registry, Yale University.

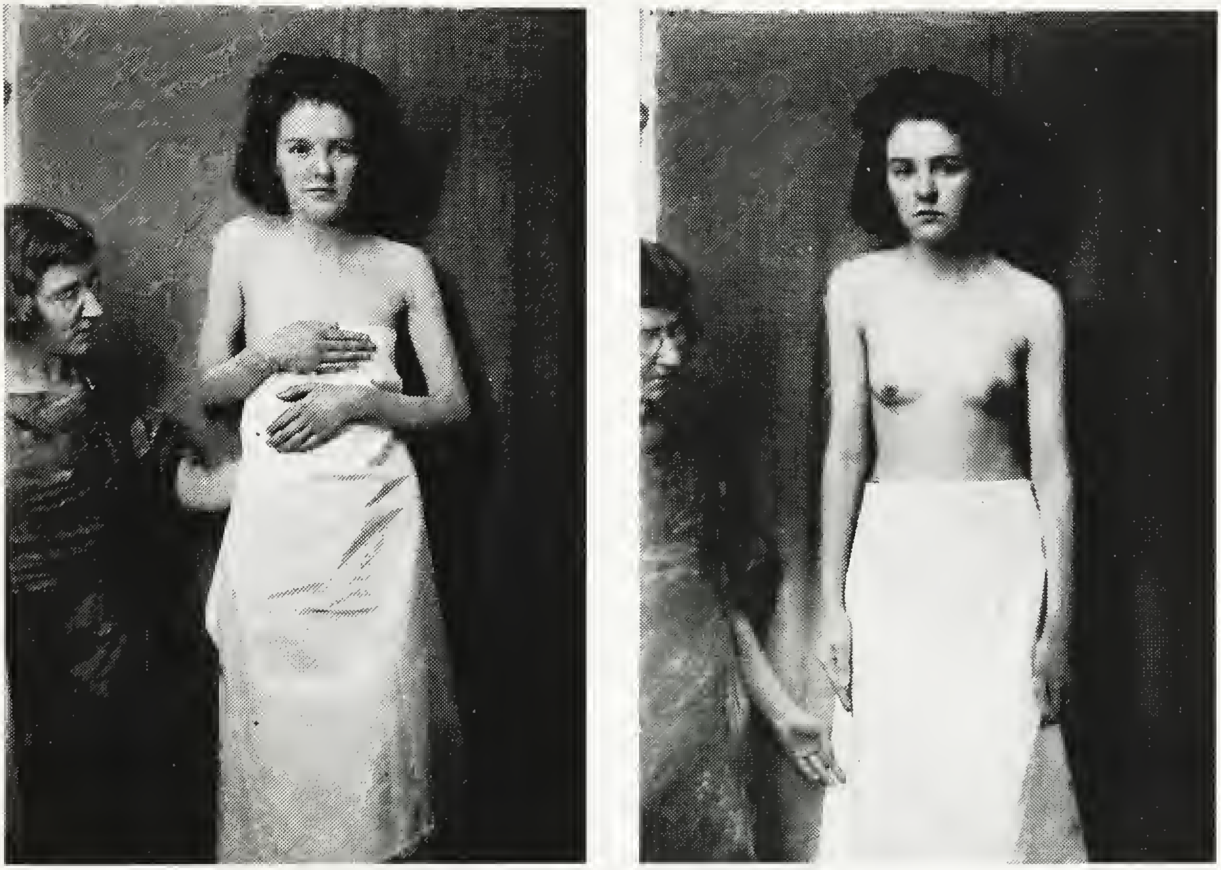




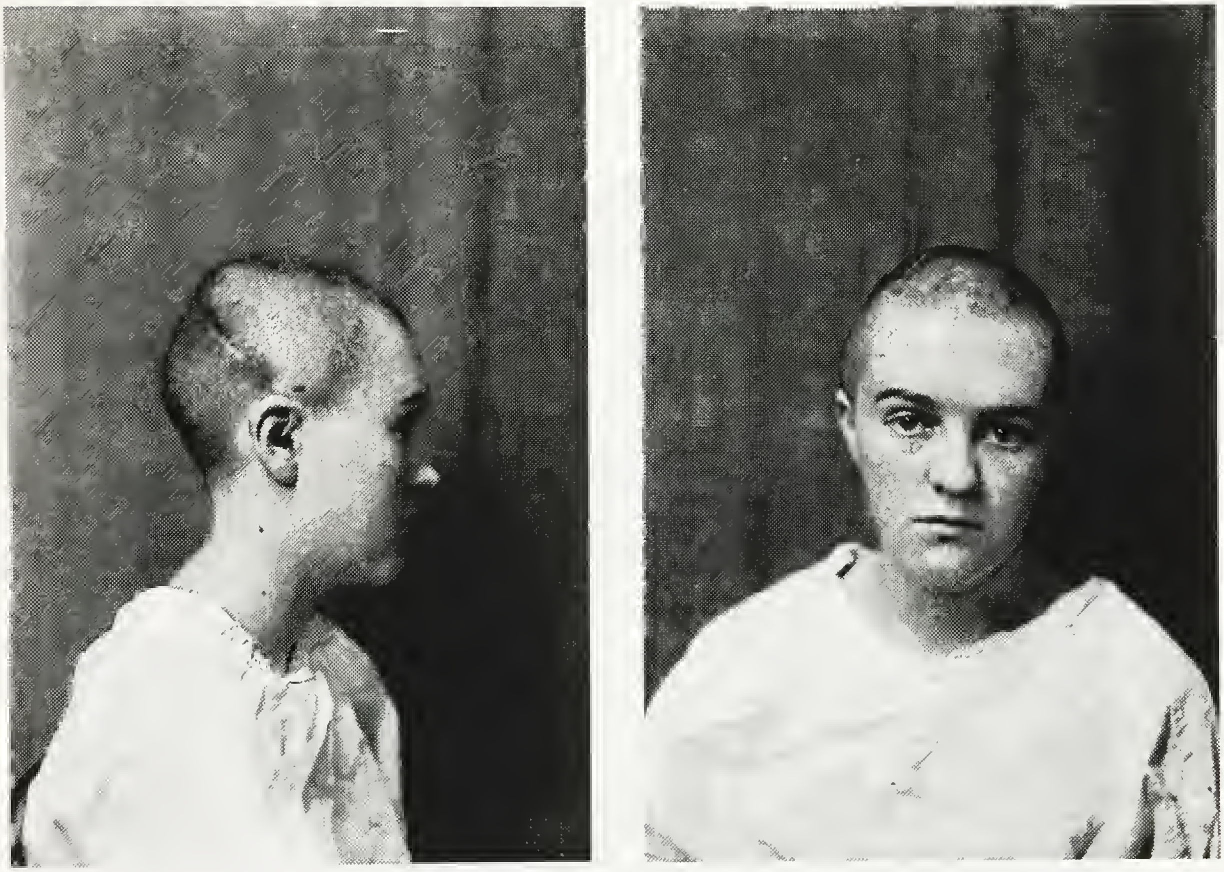
H.M., "suprasellar cyst", 1923. (Above) Postoperative photographs taken May, 1923. (Below) Histopathologic specemen prepared from gross specimen in 1928. From the Harvey Cushing Brain Tumor Registry, Yale University.

ILL. "suprasellar cyst", 1928. [illegible]
(below) Histopathologic specimens prepared from [illegible]
Cushing Brain Tumor Registry, Yale University.

H.M., "suprasellar cyst", postoperative photographs taken in January, 1933--10 years after his operation. From the Harvey Cushing Brain Tumor Registry, Yale University.

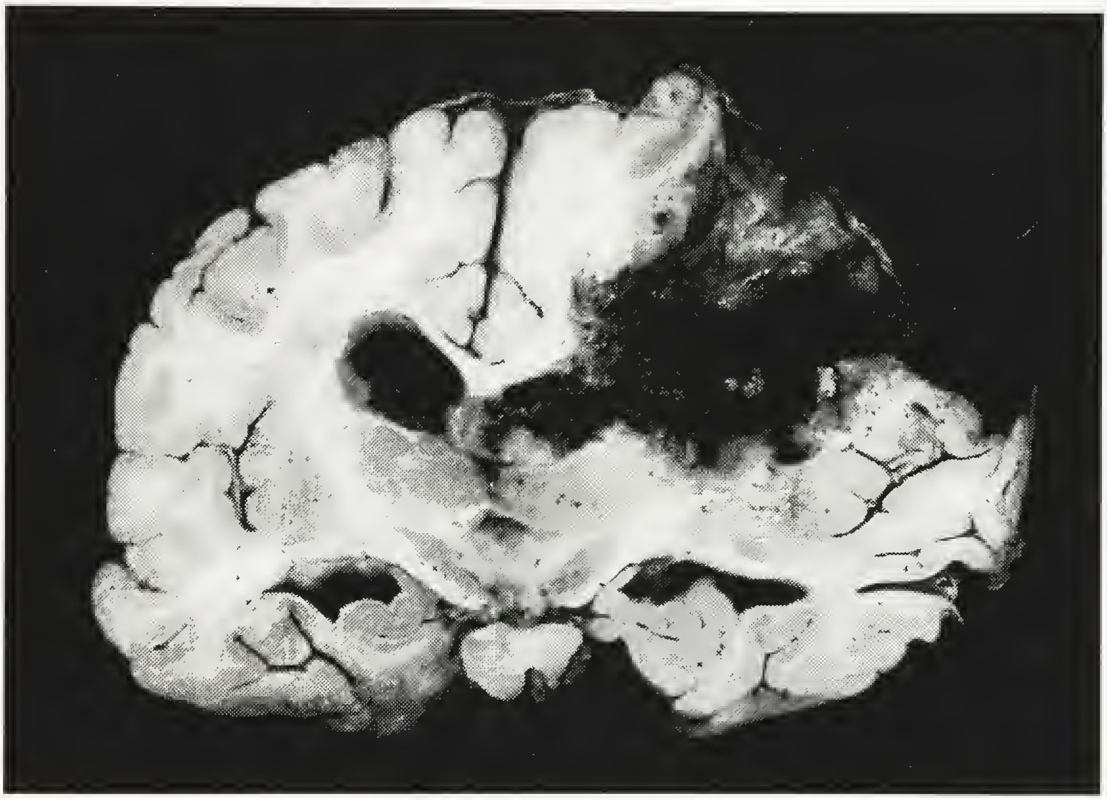


C.O., preoperative photographs taken April, 1923. From the Harvey Cushing Brain Tumor Registry, Yale University.

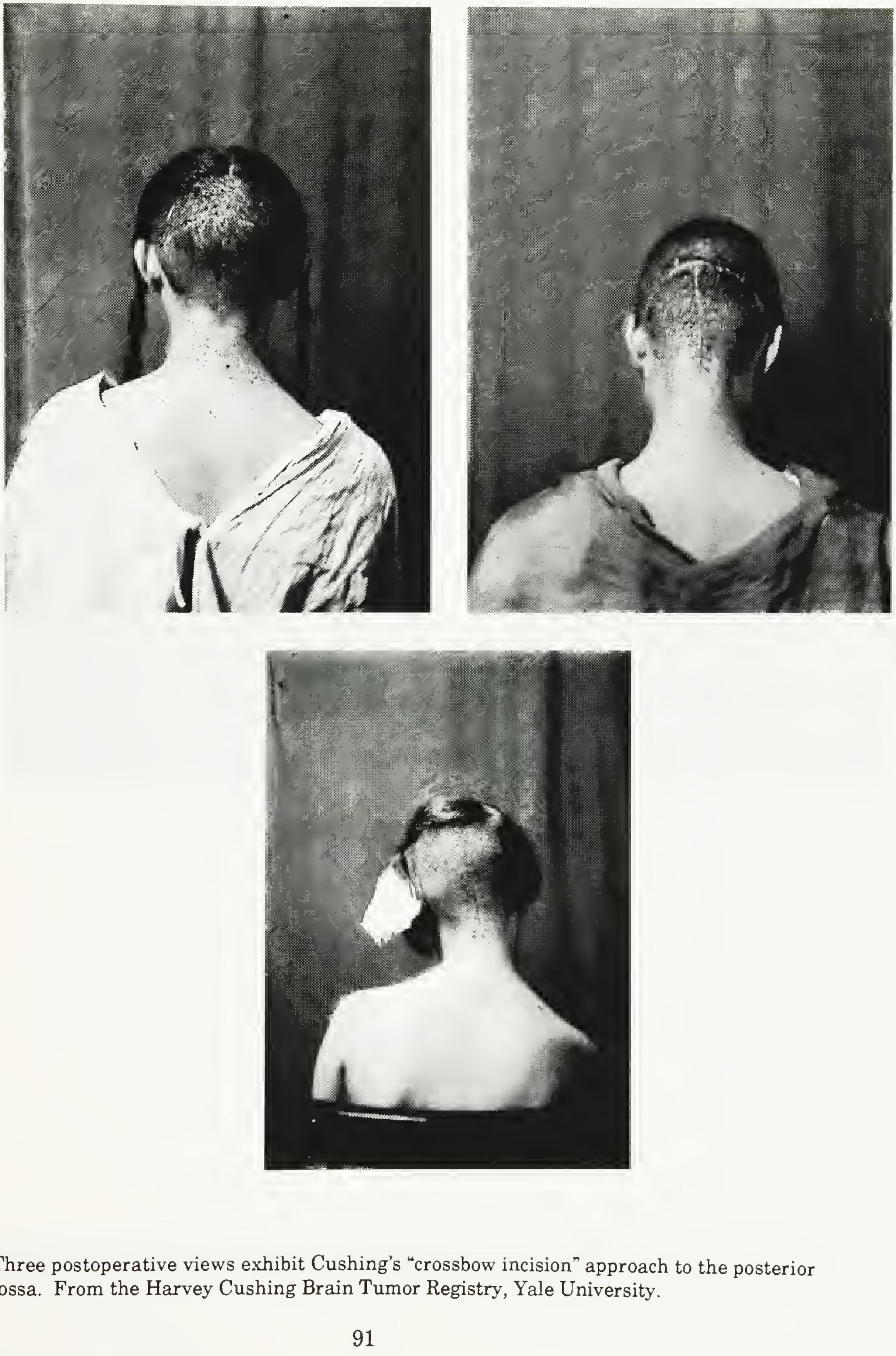


C.O., "spongioblastoma multiforme". Postoperative photographs taken May, 1923. From the Harvey Cushing Brain Tumor Registry, Yale University.

C.G., "Spongioblastoma unipolare". Postoperative photomicrographs taken Sept. 1933. From the Harvey Cushing Brain Tumor Registry, Yale University.

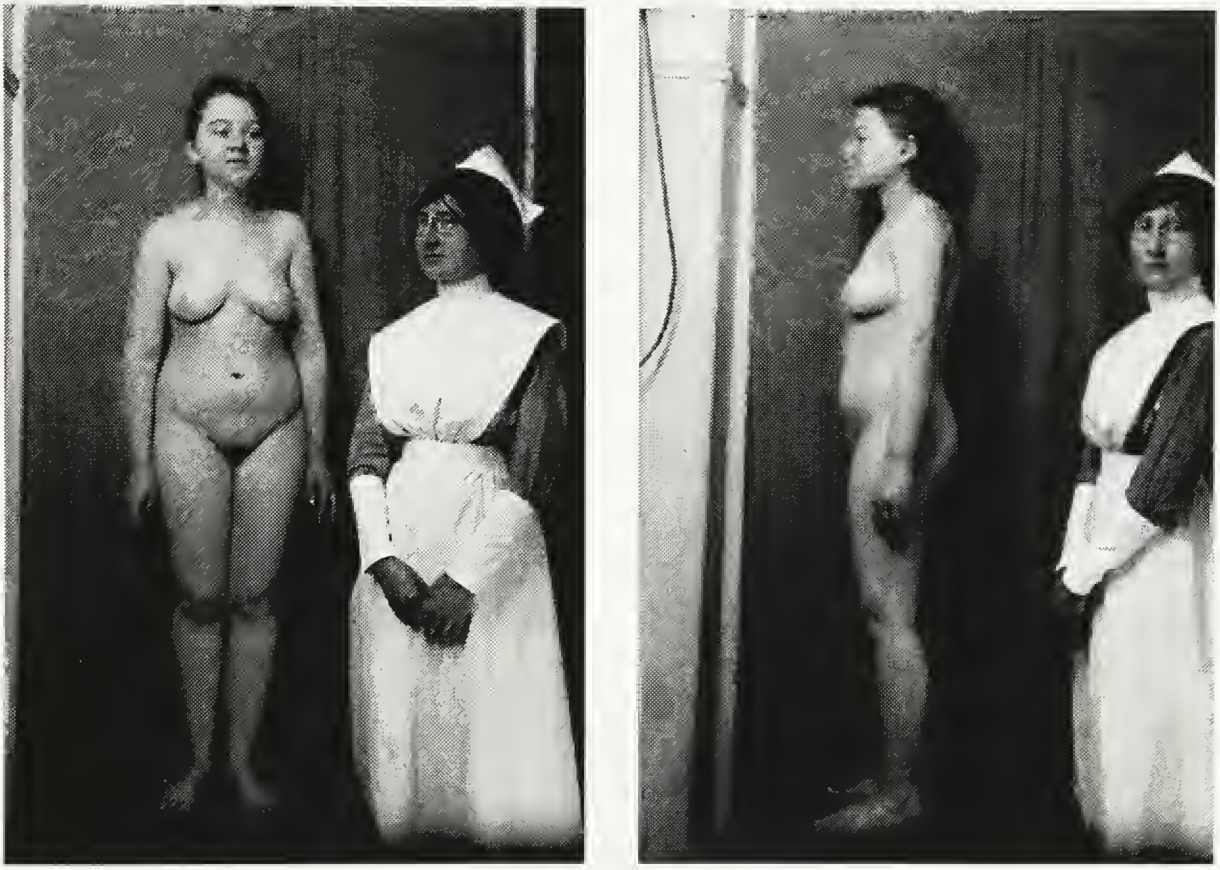


Brain specimen from C.O. Photograph taken January, 1924. From the Harvey Cushing Brain Tumor Registry, Yale University.



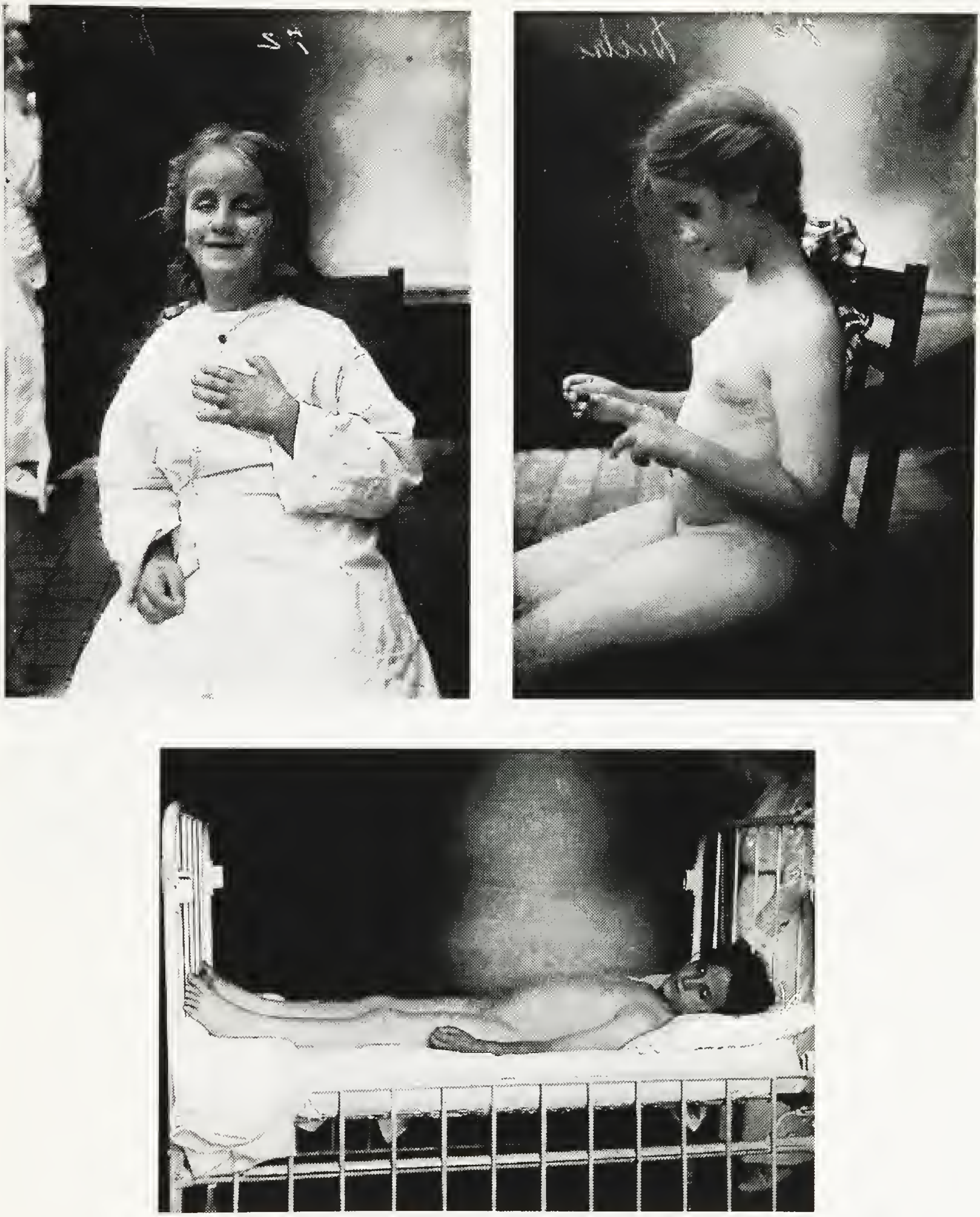
Three postoperative views exhibit Cushing's "crossbow incision" approach to the posterior fossa. From the Harvey Cushing Brain Tumor Registry, Yale University.

Three postoperative views exhibit Cushing's [illegible] in the [illegible] state. From the Harvey Cushing Brain Tumor Registry, Yale University.



J.R., "suprasellar cyst". Preoperative views taken with P.B.B.H. nurse. May, 1923.
From the Harvey Cushing Brain Tumor Registry, Yale University.

Miss G., "progeria". No operation. Cushing appears in the lower, right-hand photograph with patient's relative. From the Harvey Cushing Brain Tumor Registry, Yale University.



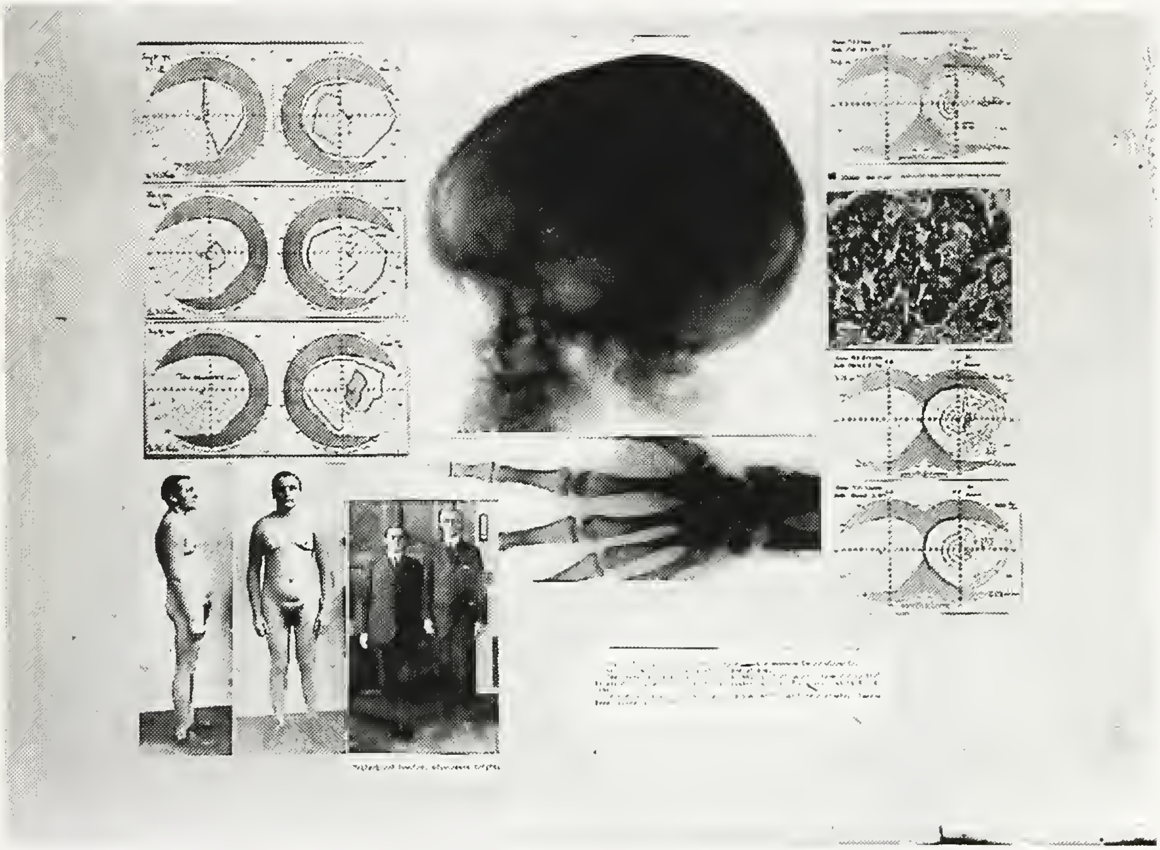
B.D., "suprasellar cyst." Patient also presented with mental retardation. Photographs taken during admission for cyst aspiration. From the Harvey Cushing Brain Tumor Registry, Yale University.

A.M., (previous burn victim) presents to Cushing with cerebellar symptoms. The photographs taken exhibit her performance on cerebellar examination. From the Harvey Cushing Brain Tumor Registry, Yale University.

J.F. and his brother. From the Harvey Cushing Brain Tumor Registry, Yale University.

R.S., a medical student who presented to Dr. Cushing at the age of 23 with 40 lbs. weight gain, diabetes, and visual changes indicative of a pituitary mass, 1912. From the Harvey Cushing Brain Tumor Registry, Yale University.

R.S. with his brother, 1912. From the Harvey Cushing Brain Tumor Registry, Yale University.



Composite photograph/lantern slide of R.S. Note worsening perimetry studies until after surgery, when R.S. regains vision almost entirely in his right eye. Pathology, skull and hand X-rays, and photographs accompany Cushing's brief clinical history. From the Harvey Cushing Brain Tumor Registry, Yale University.

P.B.H. Photographed October, 1915. From the Harvey Cushing Brain Tumor Registry, Yale University.

F.E.B. Photographed October, 1918. From the Harvey Cushing Brain Tumor Registry, Yale University.

A.S.B., an infant with multiple birth defects (craniosynostosis, polydactyly, etc.)
Photographed July, 1922. From the Harvey Cushing Brain Tumor Registry, Yale University.

A88, an infant with multiple birth defects ([illegible]).
Photographed July, 1922. From the Harvey Cushing Brain Tumor Registry, Yale University

Miss C., presenting with ascites and symptoms indicative of pituitary pathology. From the Harvey Cushing Brain Tumor Registry, Yale University.

Trigeminal neuralgia. From the Harvey Cushing Brain Tumor Registry, Yale University.

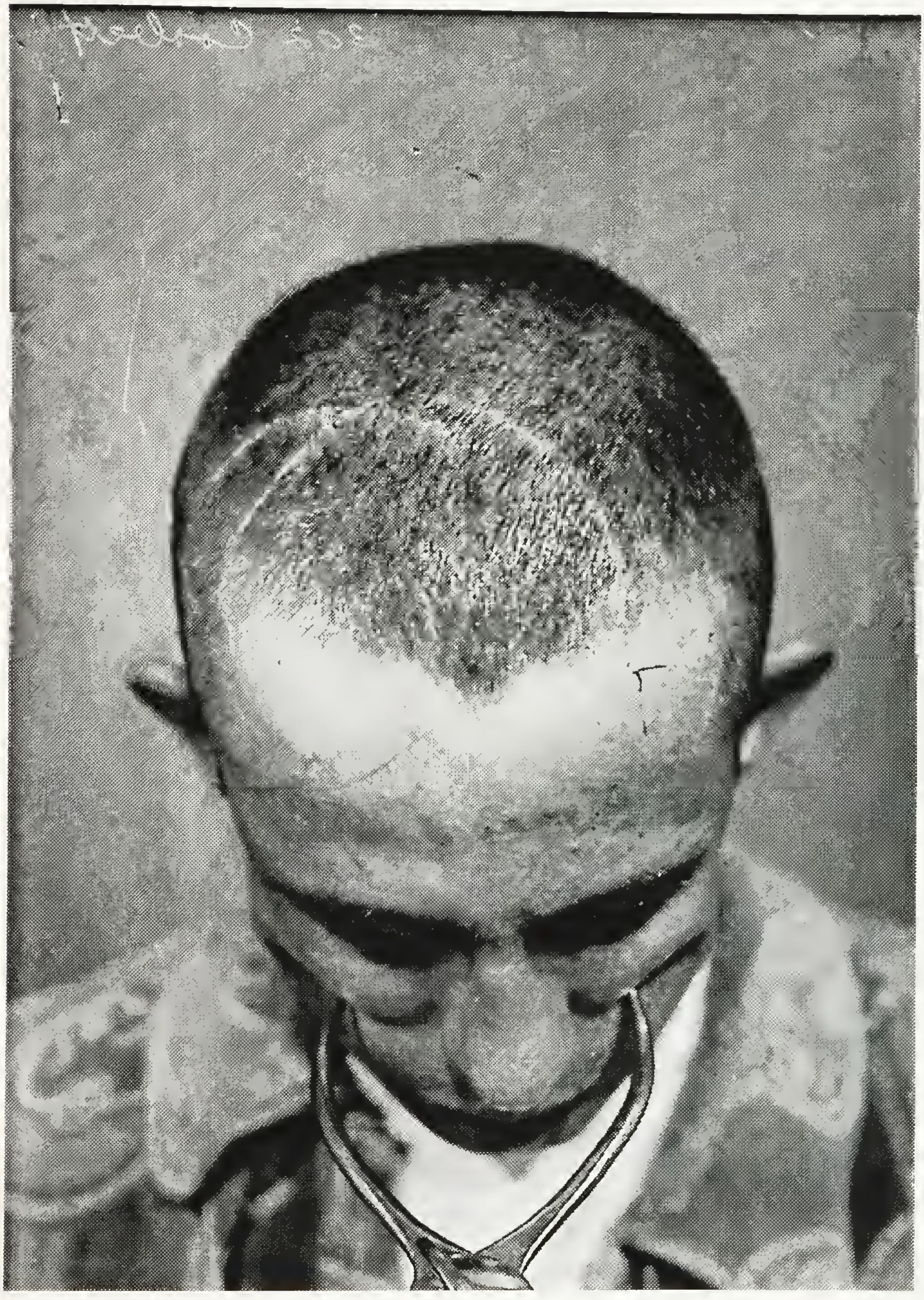
Child with crinoline pressure bandage. Several photographs were taken with motion apparent in the right arm possibly indicative of postoperative seizures. From the Harvey Cushing Brain Tumor Registry, Yale University.

Miss B., Postoperative photograph exhibits breast hypertrophy. From the Harvey Cushing Brain Tumor Registry, Yale University.

Miss R., Postoperative photograph exhibiting [illegible]. From the Harvey Cushing Brain Tumor Registry, Yale University.

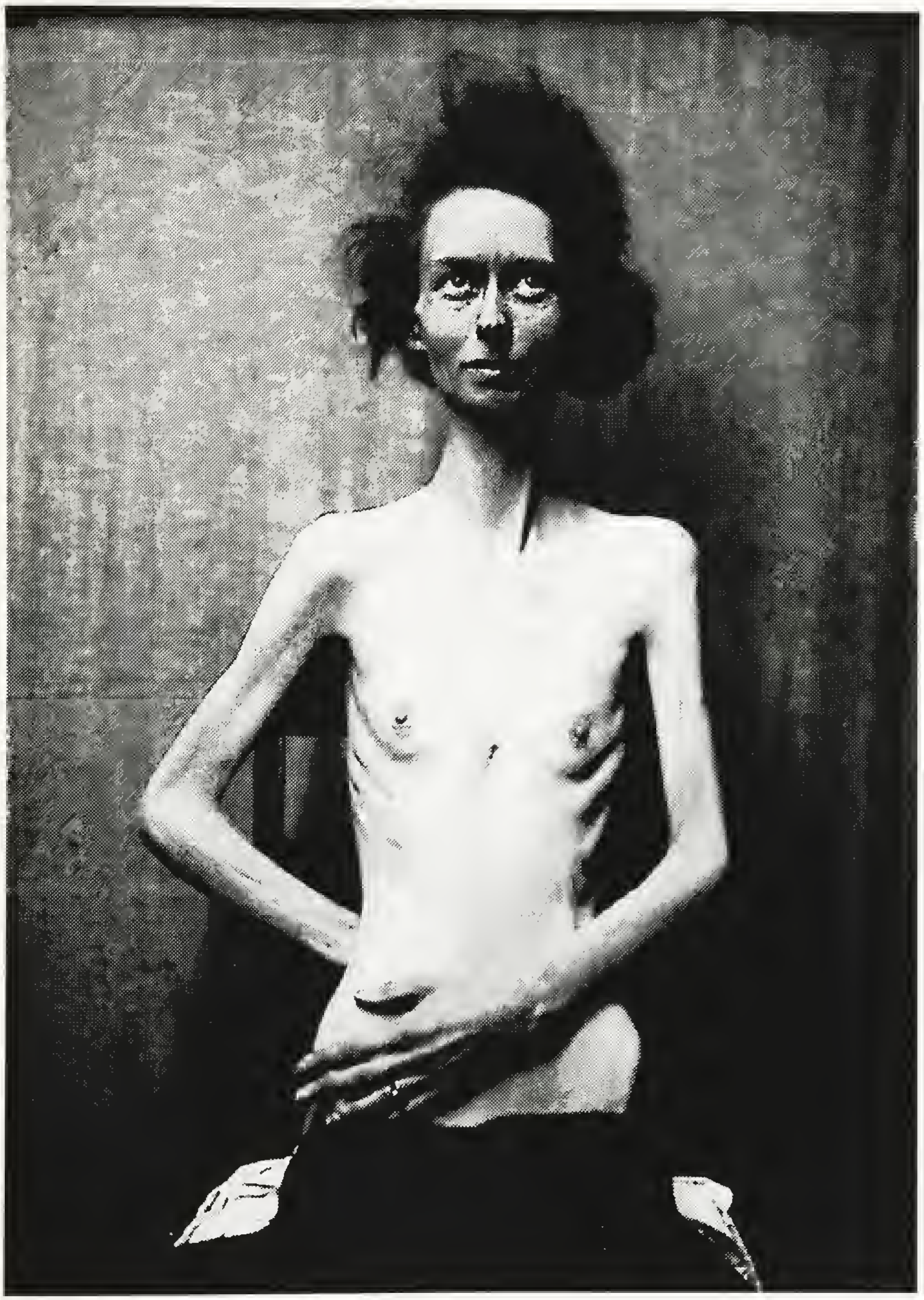
E.N., March 1923. From the Harvey Cushing Brain Tumor Registry, Yale University.

8.8, March 1985. From the Harvey Cushing Brain Tumor Registry, Yale University

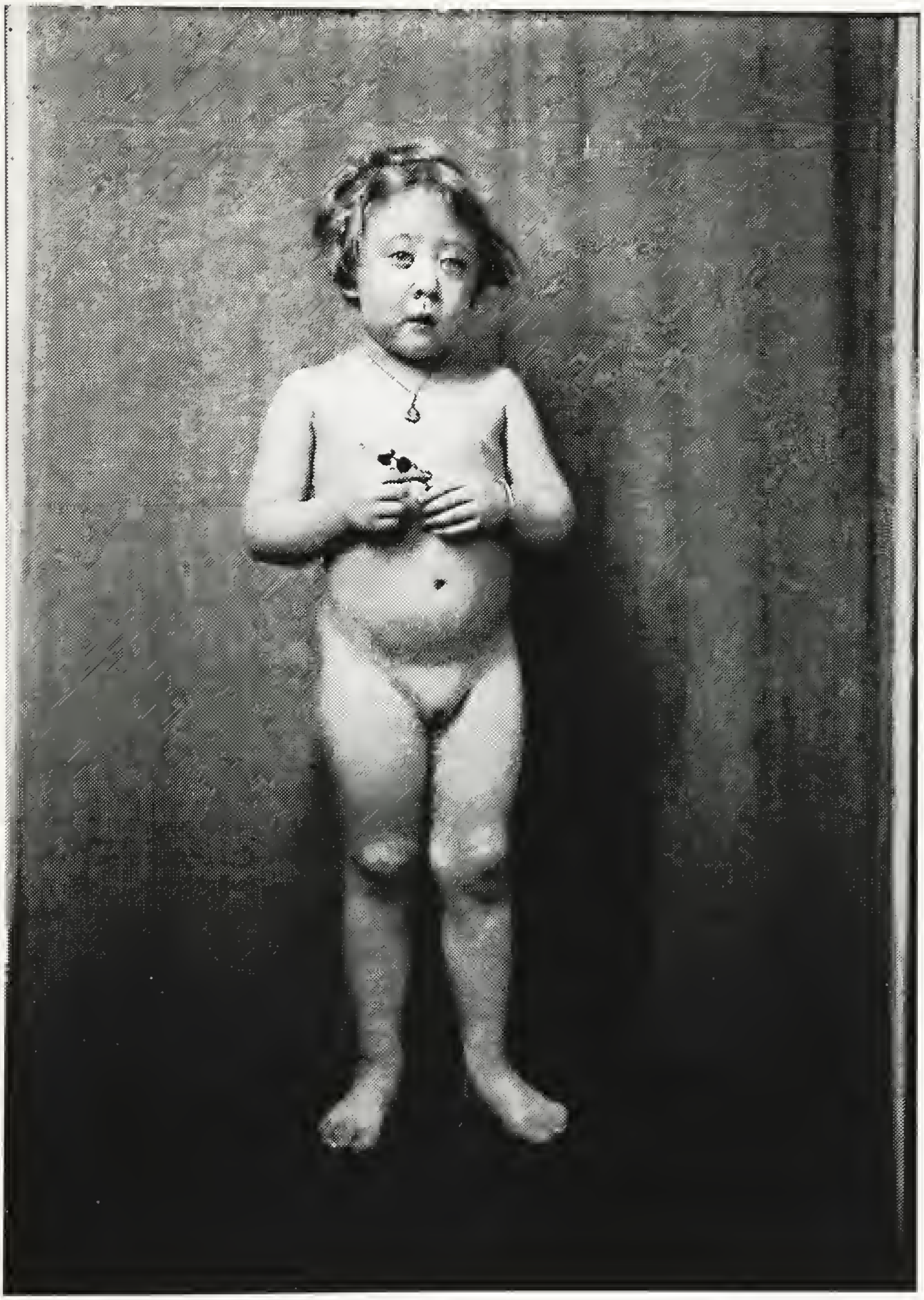


M.C., postoperative photograph with calipers to measure maxillae. From the Harvey Cushing Brain Tumor Registry, Yale University.

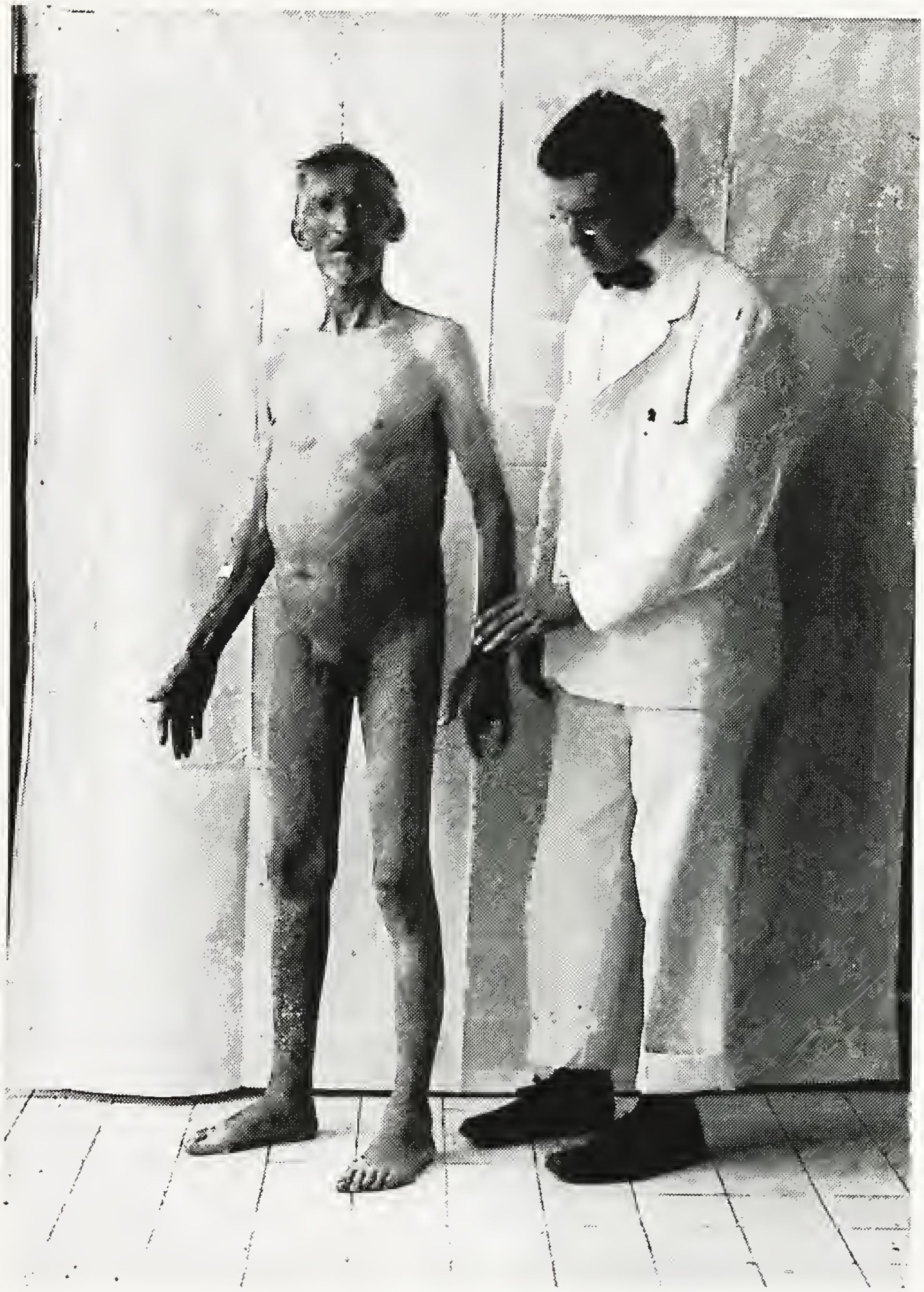
SSB, postoperative photograph with calipers to measure circulation. From the Harvey Cushing Brain Tumor Registry, Yale University.



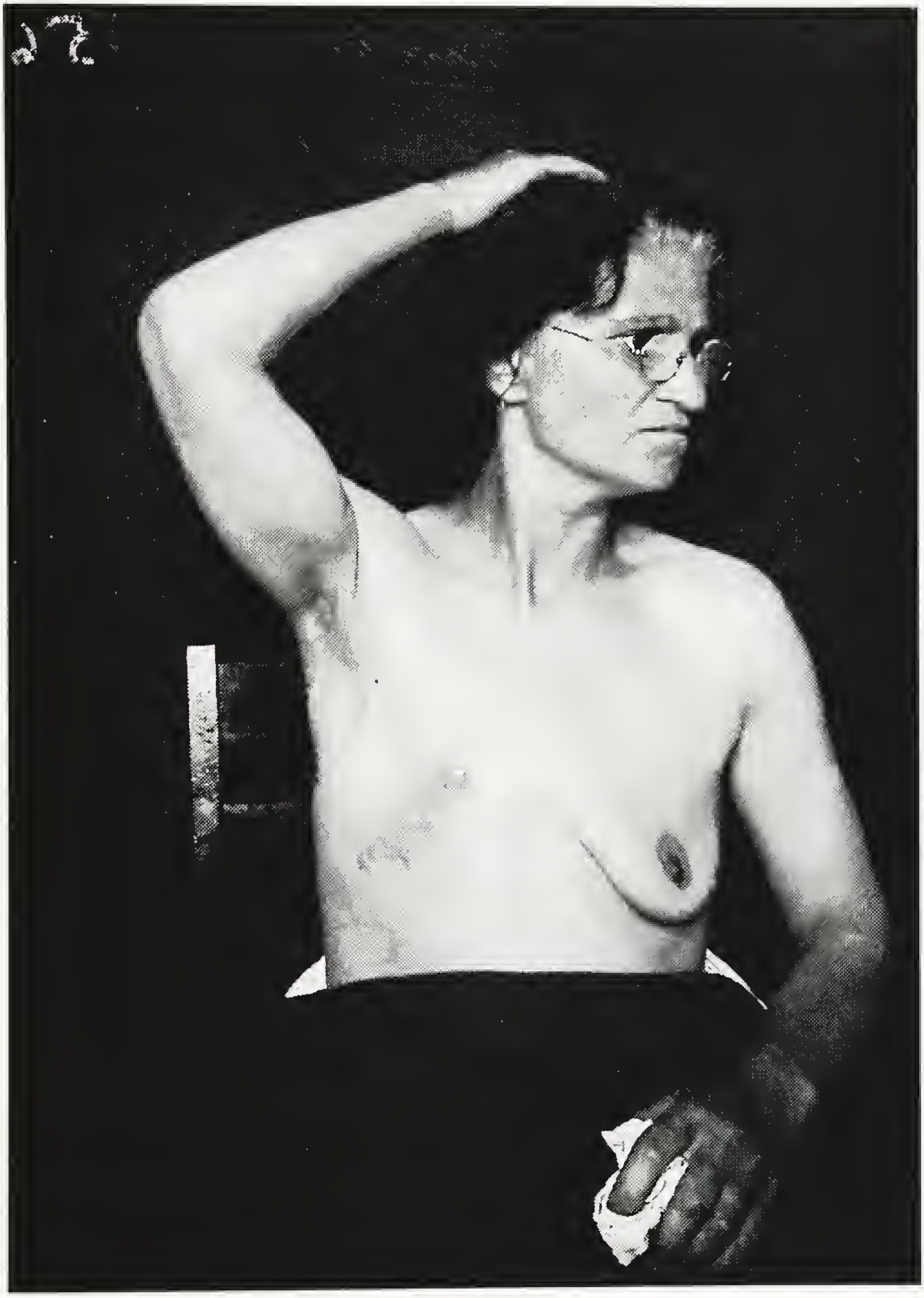
G.M.D., December, 1925. From the Harvey Cushing Brain Tumor Registry, Yale University.



D.M., "suprasellar cyst". January, 1923. From the Harvey Cushing Brain Tumor Registry, Yale University.



J.H., with P.B.B.H. house officer. From the Harvey Cushing Brain Tumor Registry, Yale University.

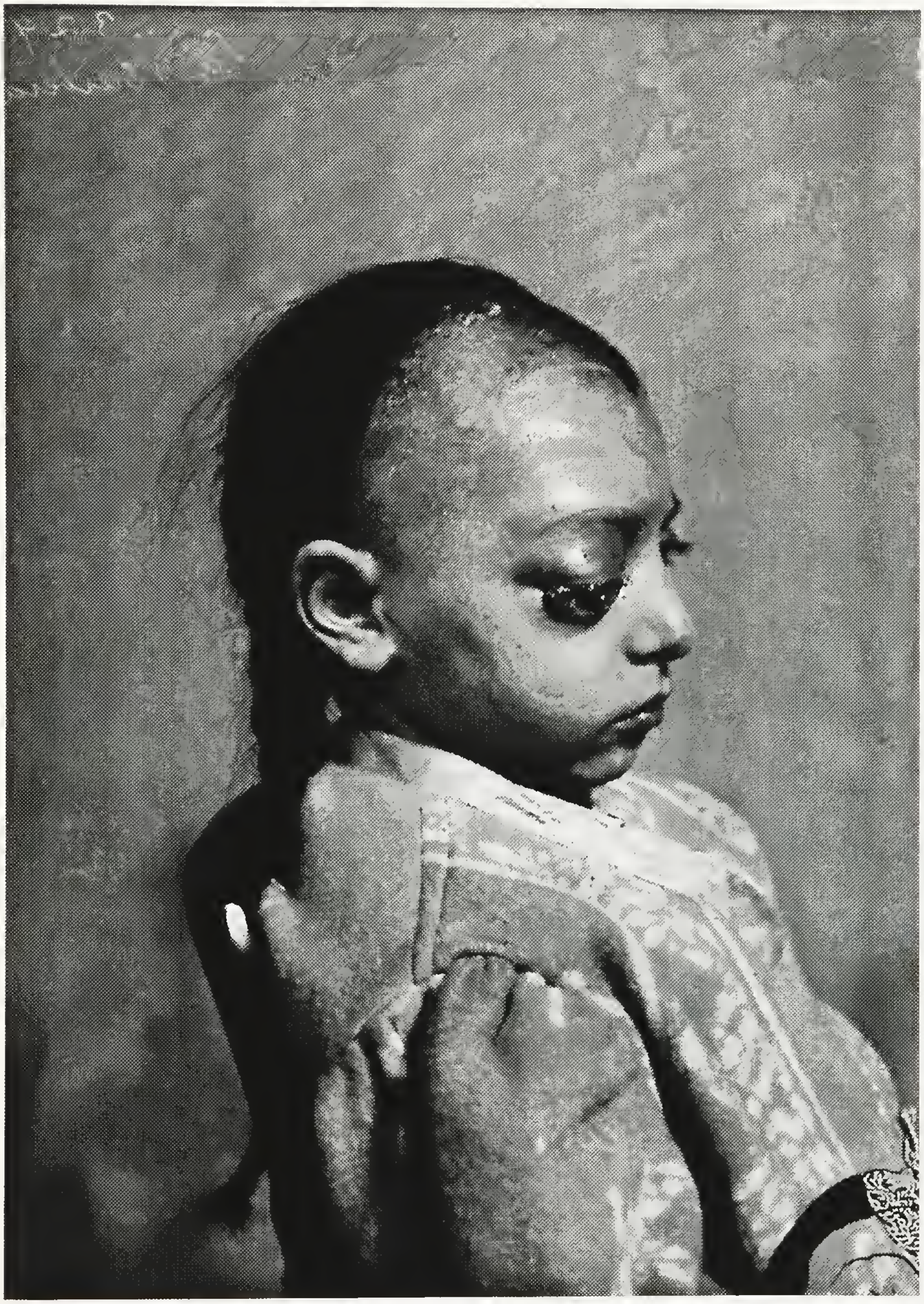


D.E., status post mastectomy. From the Harvey Cushing Brain Tumor Registry, Yale University.

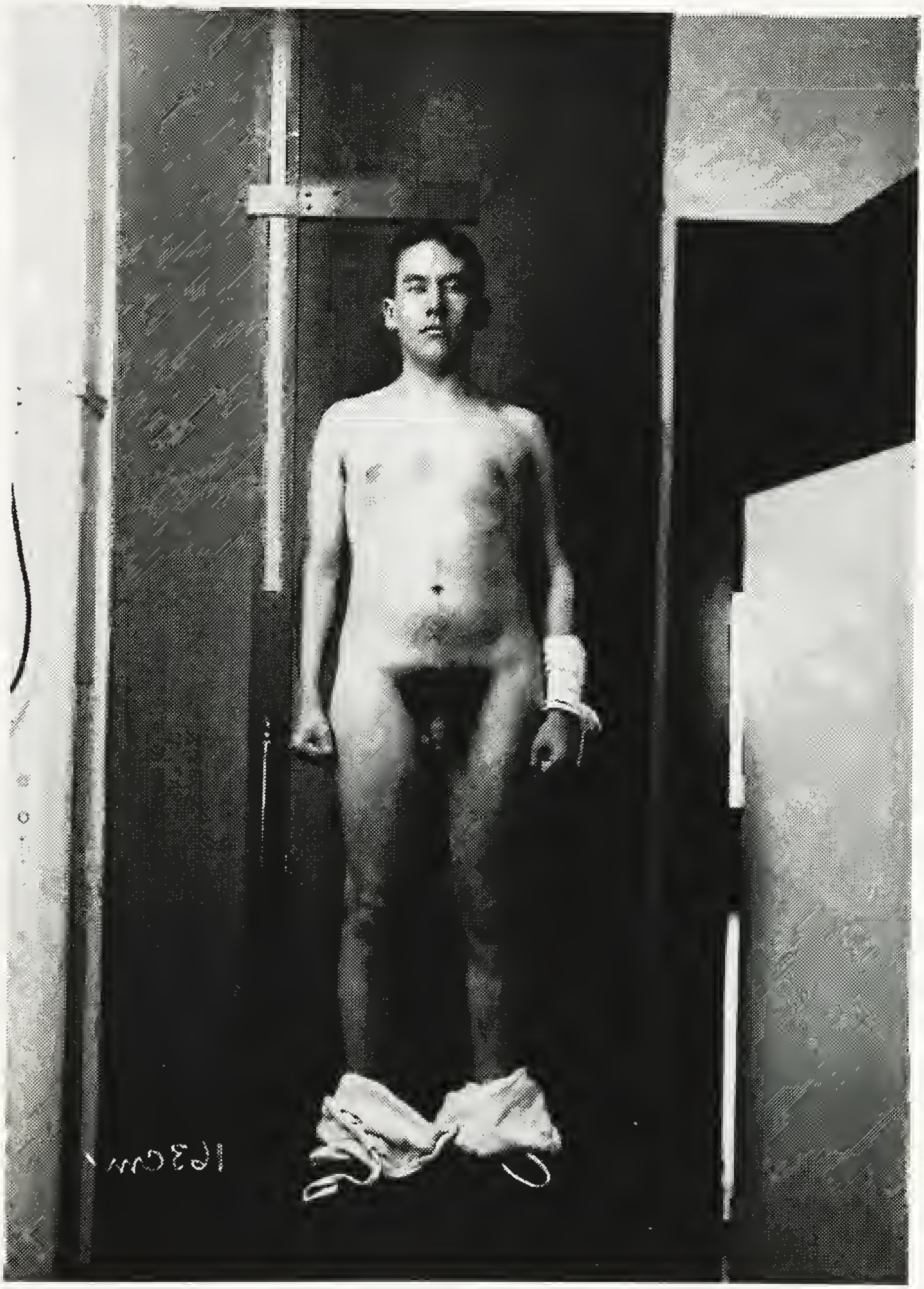
Mr. S., postoperative photograph after frontal craniotomy. December 1915. From the Harvey Cushing Brain Tumor Registry, Yale University.

Unfortunate man on gurney, incontinant with obvious atrophy of lower extremity. From the Harvey Cushing Brain Tumor Registry, Yale University.

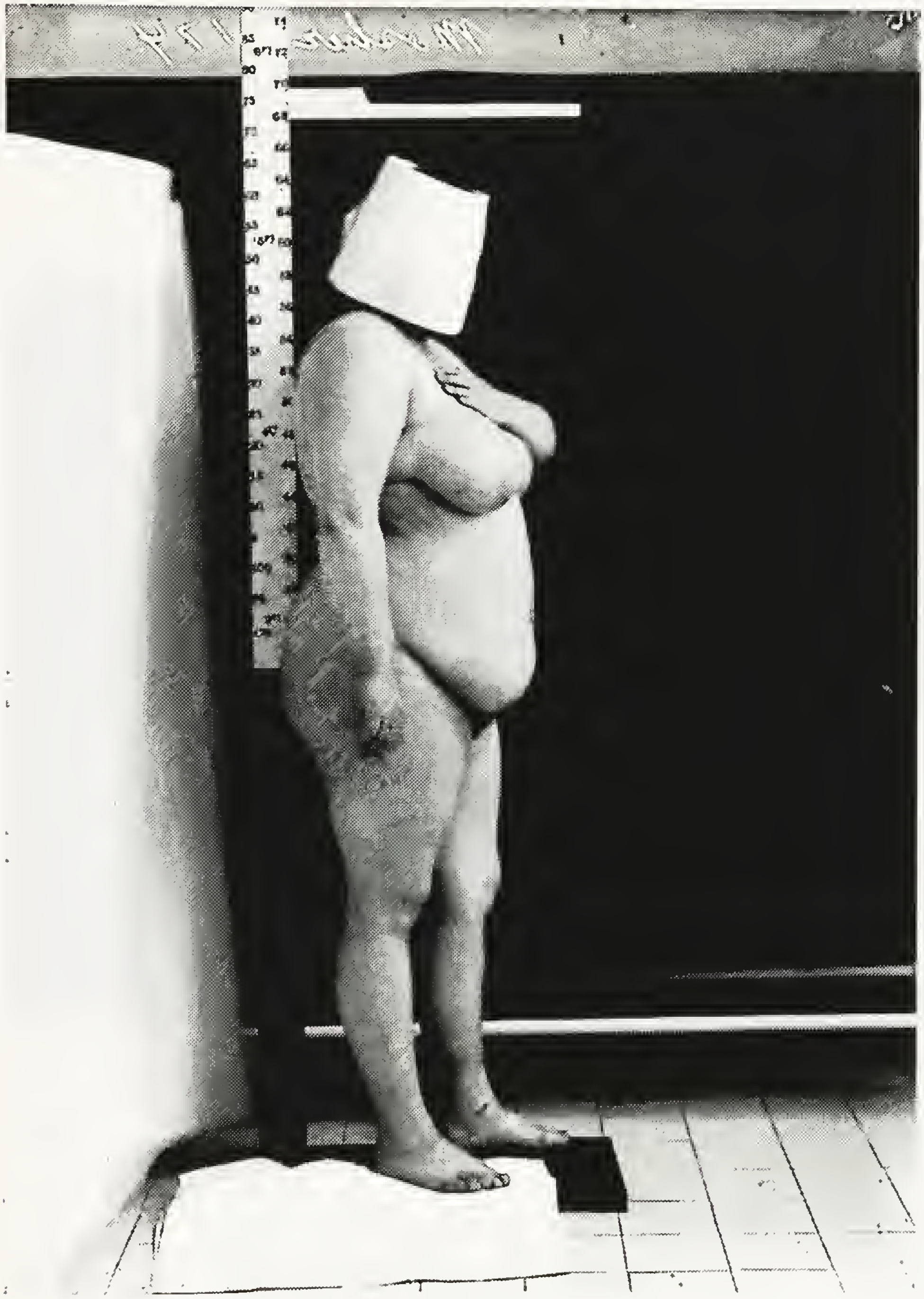
H.W., postoperative photograph with facial palsy. February, 1923. From the Harvey Cushing Brain Tumor Registry, Yale University.



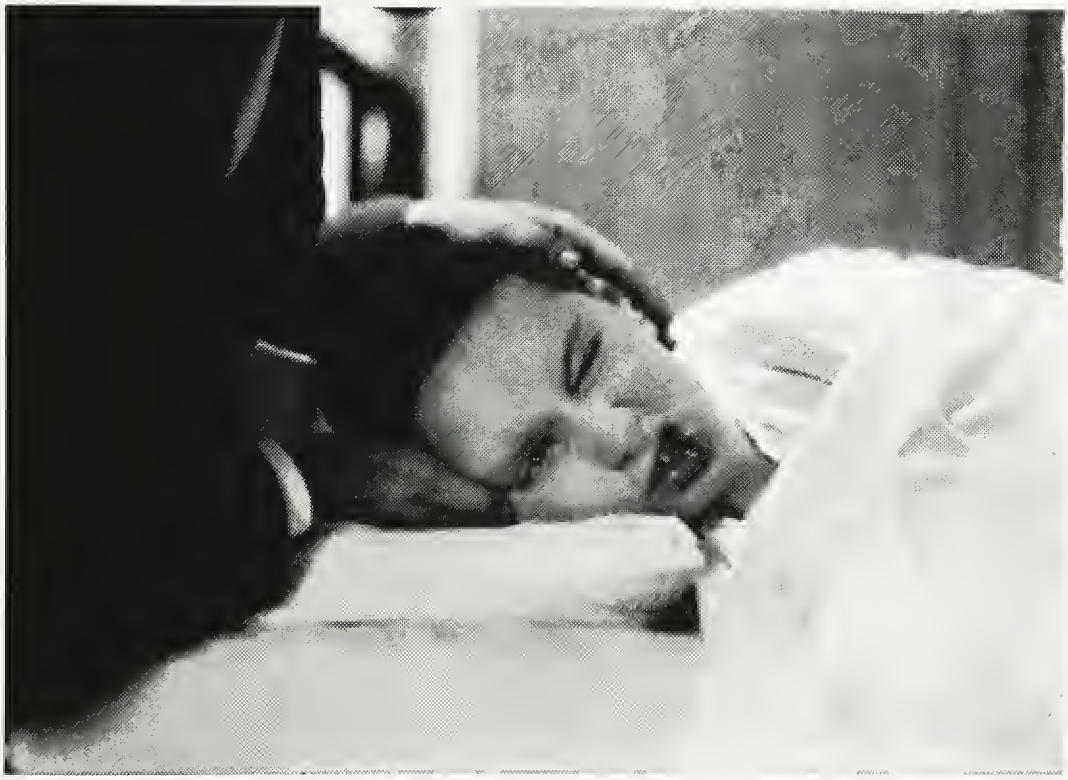
A.L., postoperative photo after frontal craniotomy. From the Harvey Cushing Brain Tumor Registry, Yale University.



R.J., habitus suggestive of pituitary pathology. June, 1922. From the Harvey Cushing Brain Tumor Registry, Yale University.



M.M., Cushing's disease. From the Harvey Cushing Brain Tumor Registry, Yale University.



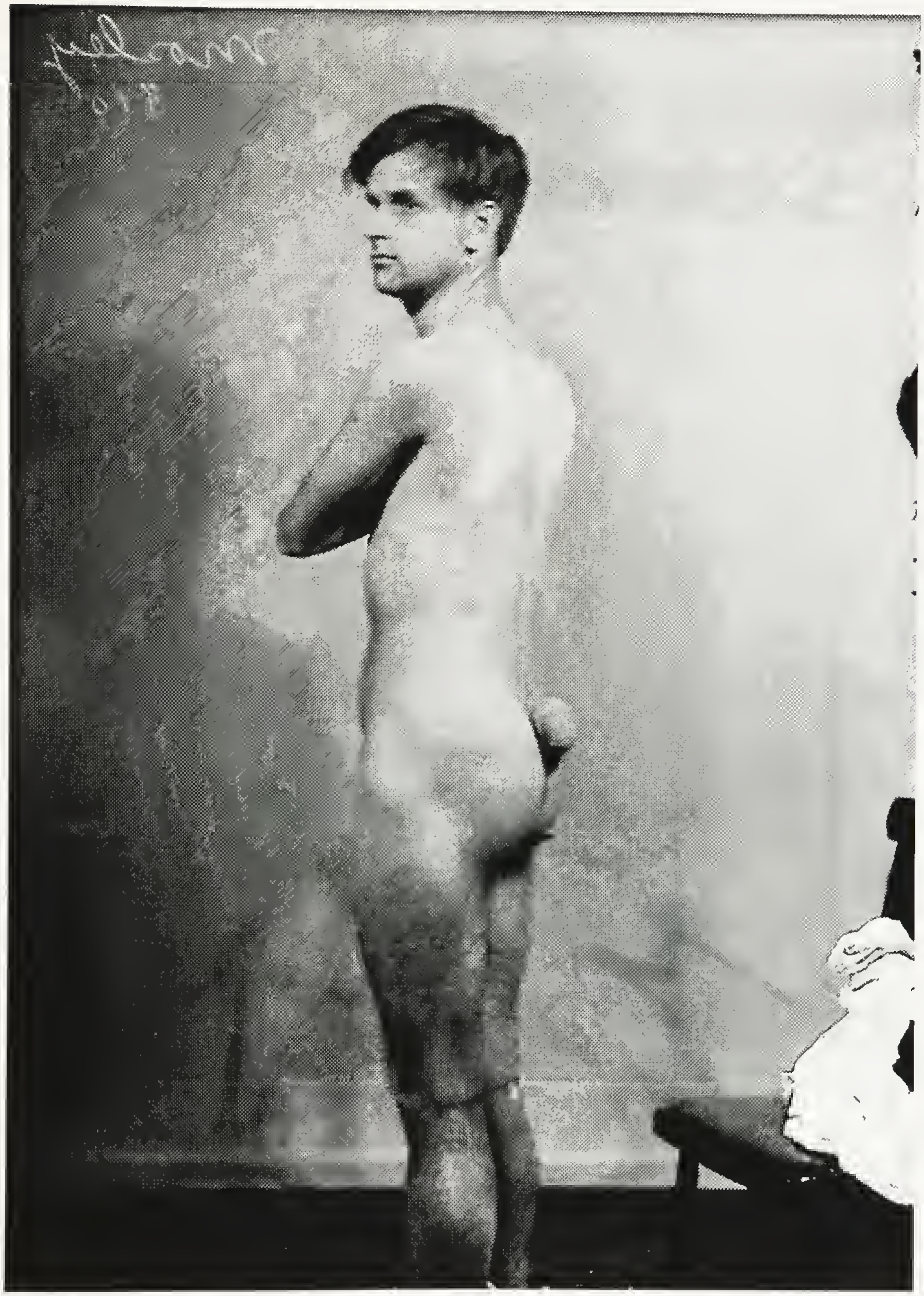
J.R., facial palsy. May, 1923. From the Harvey Cushing Brain Tumor Registry, Yale University.

E.M., postoperative abcess (eventually fatal). February, 1923. From the Harvey Cushing Brain Tumor Registry, Yale University.

Mr. M. Postoperative photograph after decompressive operation with swelling. From the Harvey Cushing Brain Tumor Registry, Yale University.

F.S., "hypertrophied breast." July 1922. From the Harvey Cushing Brain Tumor Registry, Yale University.

"Hypertrophied breast." July 1992. [illegible]
Yale University.

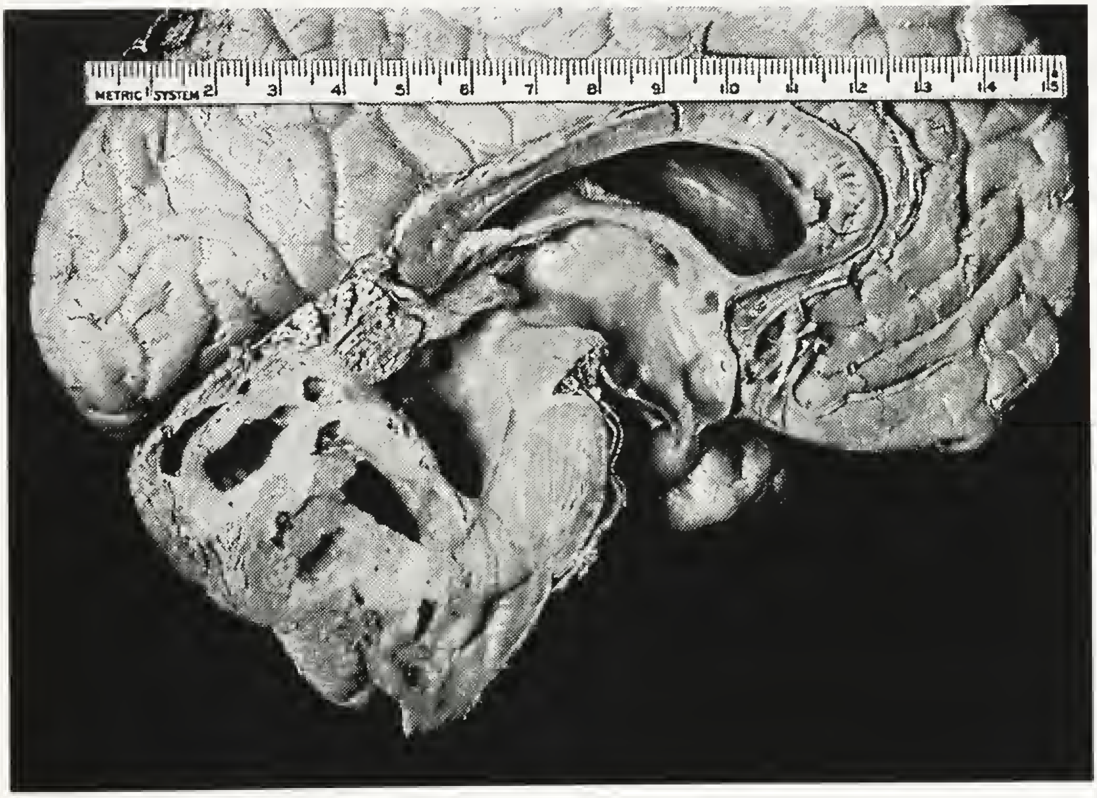


Mr. M., "meningiocele." From the Harvey Cushing Brain Tumor Registry, Yale University.

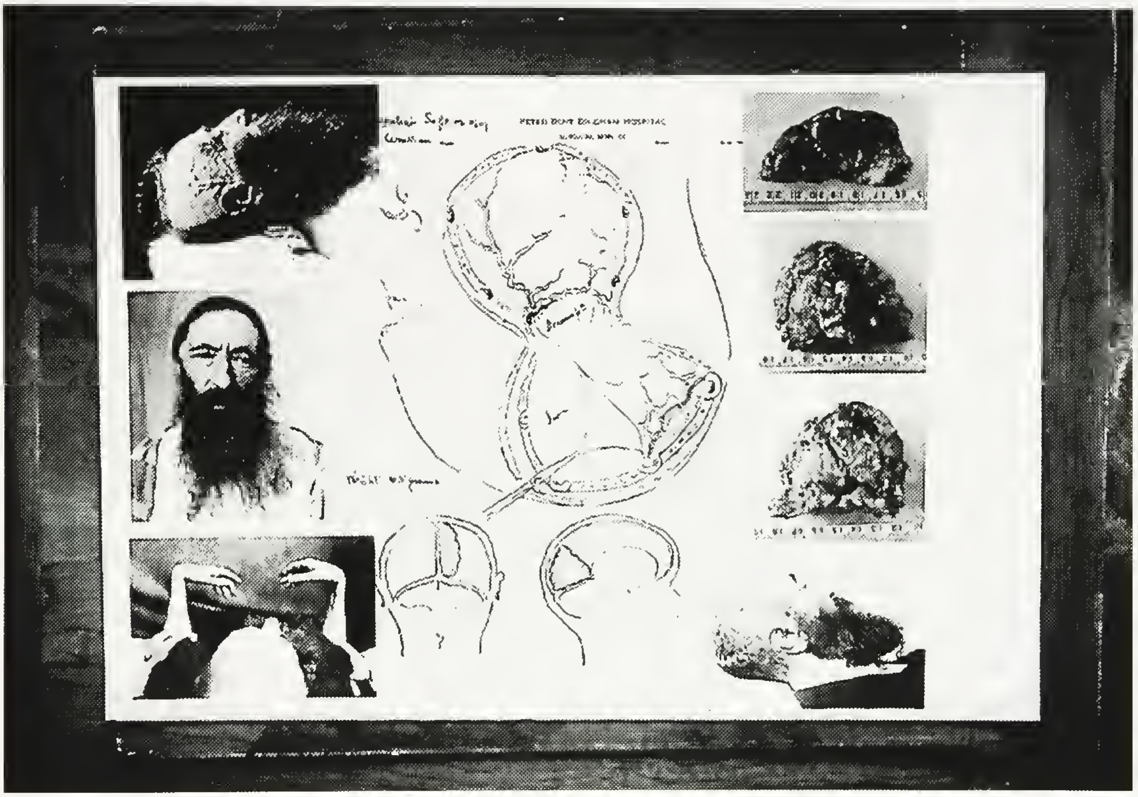
Unfortunate woman with severe scoliosis. Postoperative photograph reveals posterior craniotomy and thoracolumbar laminectomy. From the Harvey Cushing Brain Tumor Registry, Yale University.

Operative photograph of dissection of dog. From the Harvey Cushing Brain Tumor Registry, Yale University.

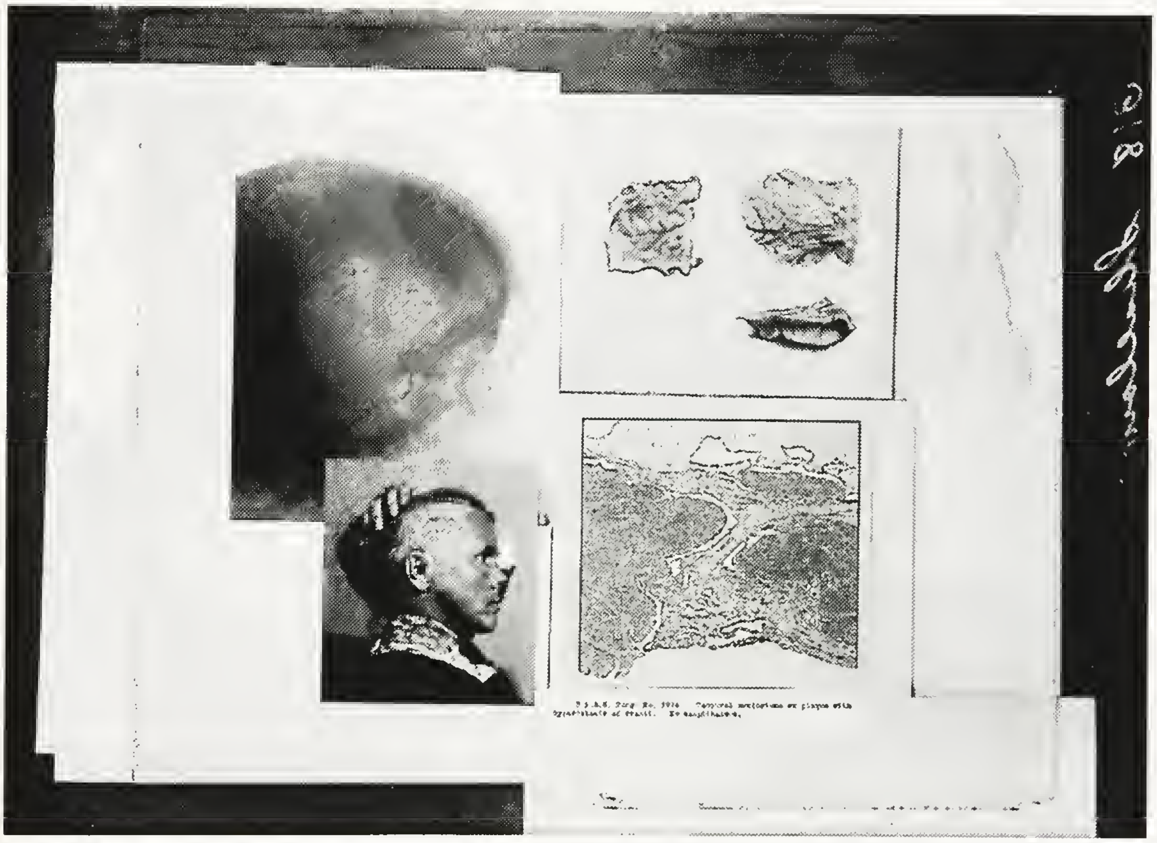
J.A., a child with severe lymphatic stasis. From the Harvey Cushing Brain Tumor Registry, Yale University.



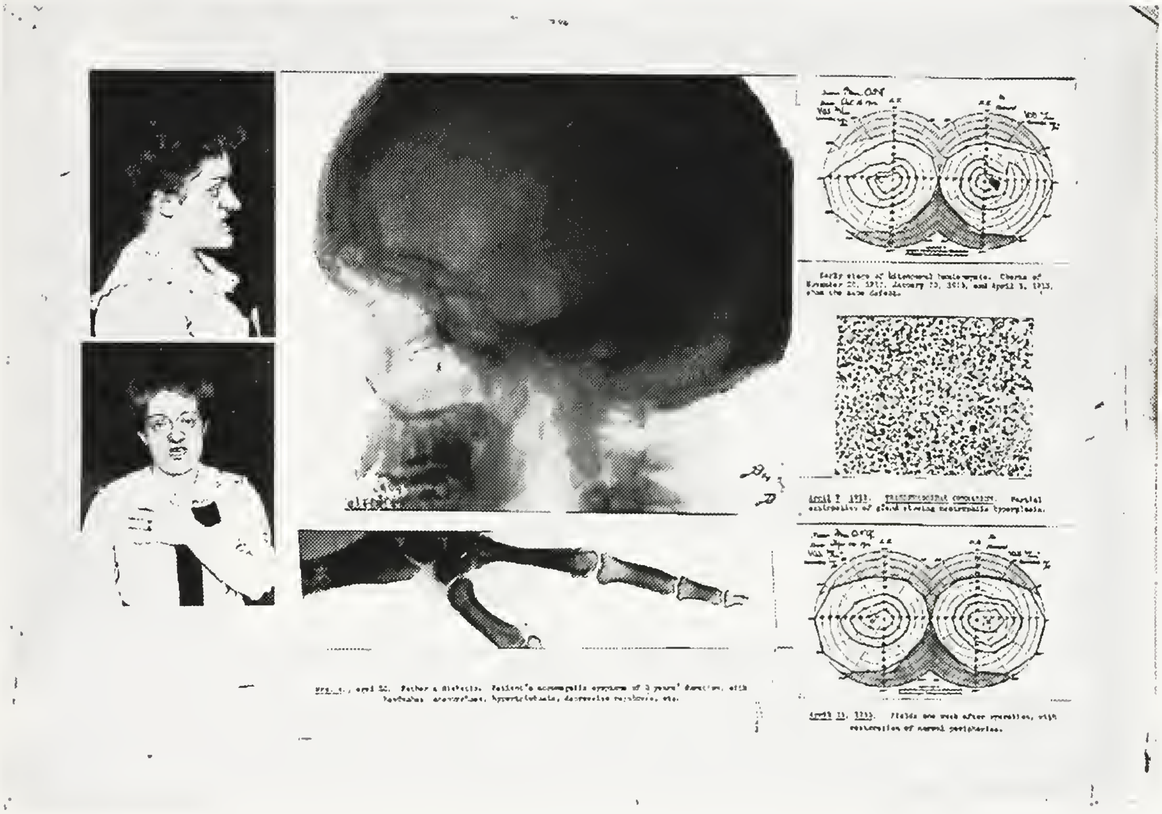
Specimen displaying large "ependymal glioma". May, 1923. From the Harvey Cushing Brain Tumor Registry, Yale University.



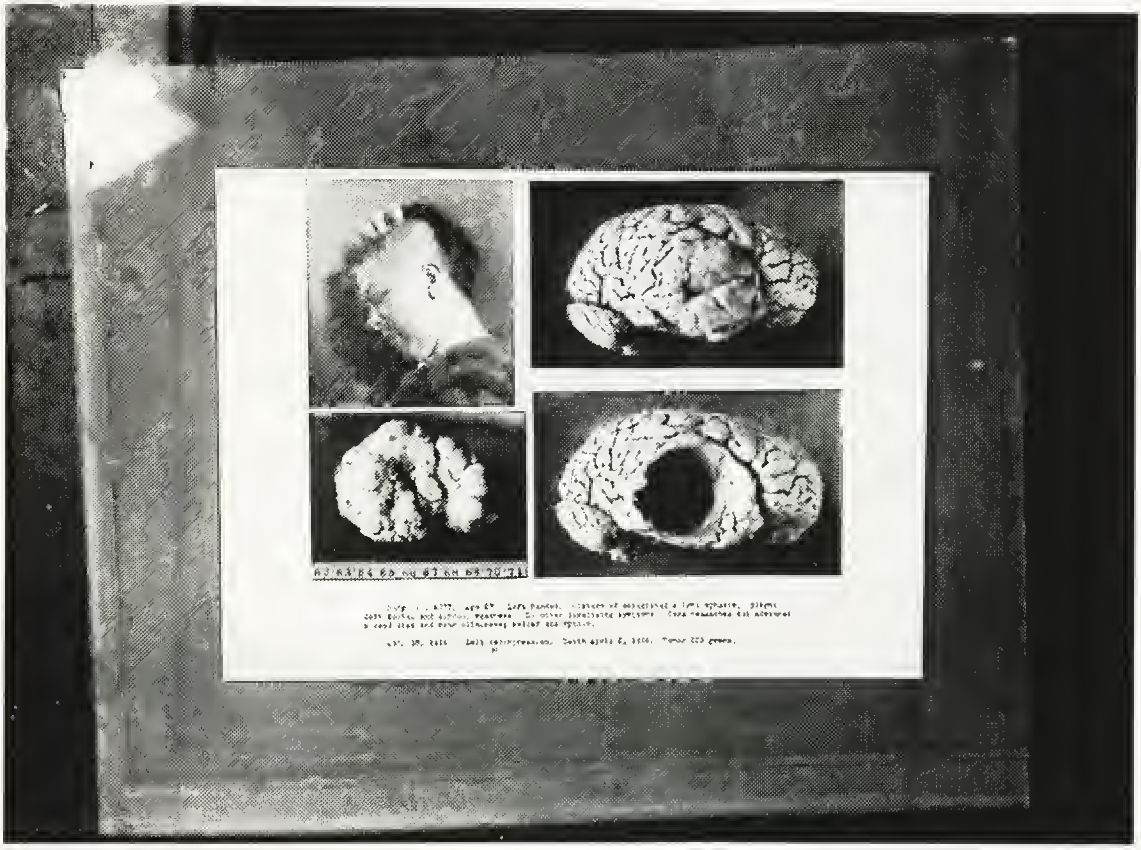
Composite photograph/lantern slide of M.W., who suffered from a massive occipito-parietal glioma. Preoperative photographs, intraoperative sketch, tumor specimens, and postoperative photograph. From the Harvey Cushing Brain Tumor Registry, Yale University.



Composite photograph/lantern slide of E.S., "temporal meningioma en plaque with hyperostosis of cranii." Postoperative photograph, skull X-ray (note silver clips of Cushing's design), histopathological photomicrograph, and drawing by Mildred Codding. From the Harvey Cushing Brain Tumor Registry, Yale University.



O.R., with classic acromegaly. Preoperative photographs, skull X-ray showing erosion of sella, digital X-ray, histopathological photomicrograph, and pre- and postoperative perimetry studies. From the Harvey Cushing Brain Tumor Registry, Yale University.



Composite photograph/lantern slide of M.C., with aggressive glioblastoma. Postoperative photograph (decompressive procedure), tumor and brain specimens. Patient died in April of 1916, less than four months after the surgery. From the Harvey Cushing Brain Tumor Registry, Yale University.

Louis Agassiz and Samuel Morton: The Theories of Polygeny as a Prelude to Darwin

A physical fact is as sacred as a moral principle.
Our own nature demands from us this double allegiance.
Louis Agassiz

Portrait of Dr. Louis Agassiz. From *Louis Agassiz: His Life and Correspondence.* p. 401.

It seems intuitive that Harvey Cushing's distinction as a surgeon and scientist might have insured that his Brain Tumor Registry be preserved and displayed from its very inception. History largely ignored Cushing's weaknesses as a researcher; his clinical acumen, meticulous, innovative operative technique, and reputation as a champion of the Homeric tradition of observation superseded those flaws. Yet somehow Harvard never took interest and Yale's investment waned with the declining scientific utility of the collection.

Perhaps much of this trend is an artifact of the nature of science. A scientist's pragmatism may outweigh his enthusiasm for tradition, and in such cases where there the articles of the scientific pursuit no longer contribute to novel thought, the physical products of past science are almost invariably discarded. This is especially true when changing modes of belief render the prior science hollow, or when the scientist never attains significant notoriety. Cushing's Tumor Registry

represents a collection of data by a scientist of inordinate merit, pursuing theses which have been borne out in the modern paradigm. On the contrary, the collections of 19th century polygenists Louis Agassiz and Samuel Morton represent the labors of famous researchers trying a thesis which has been all-but-dismissed in the context of modern thought. Regardless, however, we see that the physical products of their endeavors are of scientific and historic interest.

Swiss-born Louis Agassiz, a naturalist and comparative zoologist moved to the United States in the 1840's. He, like the majority of scientists of his day, was a creationist, who struggled with issues concerning the relationships of different species. Agassiz's contributions to biology lie primarily in the classifications of fossil fishes and in the study of reefs and aquatic species. With his immigration, and consequently his professorship at Harvard, he founded the Museum of Comparative Zoology and became a distinguished figure among intellectual and social circles in New England and the South.

Agassiz's reputation as a taxonomic biologist blossomed after he came to the United States. He tended toward "splitting" species in his classifications: concentrating heavily on the differences in morphology between separate and similar species alike. For the most part, pre-Darwinian modes of thought dictated that all species, created at a single geographic focus, migrated extensively to assume roles in the various niches worldwide. Agassiz spent most of his career traveling to geographic areas, cataloging the distributions of animals and plants within those areas in an effort to better elucidate the interrelationships and possible migratory behaviors of species. His research eventually led him to postulate the theory of *polygeny*: the concept that contrary to commonly held belief, species must have originated at separate "centers of creation" across the globe, migrating only to a small degree. The theory is motivated to a large part by Agassiz's studies of mating, behavioral, and populational patterns. Most creationists viewed the creation of man to be about 4000 years prior to the 19th century, and by his calculations, Agassiz found it impossible for animals and plants to have migrated to such an extent in so short a time. In addition, he noted far too many differences between similar species in different locales. Only through separate creations of species specifically suited to their environments could Agassiz account for the observed patterns of species variation and distribution.[93] He began a taxonomic endeavor which eliminated many of the regionally distinct "races"

represents a collection of data by a scientist of [illegible] concerning theories which have been borne out in the modern paradigm. On the contrary, the collections of 19th century polygenists Louis Agassiz and Samuel Morton represent the labors of famous researchers trying a theory which has [illegible] in the context of modern thought. Regardless, however, we see that the physical products of their endeavors are of scientific and historic interest.

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proposed by the classicist "creation-migration" scientists, recategorizing them as separate "species" native to their regions.

Initially, Agassiz stopped short of including man among polygenic species. Certainly the tenor and influence of religion within the 19th century social construct, so deeply ingrained in the educational curriculum of any civilized scholar, moderated the bias. Agassiz probably fancied himself more a scientist than a theologan; he was not a nineteenth century Galileo Galilei, who feared trial for his radical views. Theology certainly played farther *unconsciously* into Agassiz's reasoning than it did consciously--it is plausible that his theories of polygeny excluded man simply because, in the social environment, it wouldn't have occurred to him that man, created in God's image, should not have been one unified species. Agassiz wrote: "Here is revealed anew the superiority of the human genre and its greater independence in nature. Whereas the animals are distinct species in the different zoological provinces to which they appertain, man, despite the diversity of his races, constitutes one and the same species over all the surface of the globe."[94] [95]

The tenuous reservation disintegrated with Agassiz's first encounter with a living man of color. His acerbic description of the event, written home to his mother in 1846, bears witness to a revulsion which eventually coerced him to change his views concerning races of man:

> ...I can scarcely express to you the painful impression that I received, especially since the feeling that they [the negroes] inspired in me is contrary to all our ideas about the confraternity of the human type [genre] and the unique origin of our species. ...I experienced pity at the sight of this degraded and degenerate race, and their lot inspired compassion in me in thinking that they are really men. Nonetheless, it is impossible for me to repress the feeling that they are not of the same blood as us. In seeing their black faces with their thick lips and grimacing teeth, the wool on their head, their bent knees, their elongated hands, their large curved nails, and especially the livid color of the palm of their hands, I could not take my eyes off their face in order to tell them to stay far away. And when they advanced that hideous hand towards my plate in order to serve me, I wished I were able to depart in order to eat a piece of bread elsewhere, rather than dine with such service. What unhappiness for the white race--to have tied their existence so closely with that of negroes in certain countries! God preserve us from such a contact![96]

Stephen Gould translated the final two lines from the original manuscript in Harvard's Houghton Library. They had been omitted by his wife when she edited *Louis Agassiz: His Life and Correspondence.*[97]

Another factor contributing to the theory of polygeny was Louis Agassiz's collusion with Dr. Samuel Morton, a Philadelphia data analyst and collector of human skulls. Agassiz describes his interaction with Morton:

> Dr. Morton's unique collection of human skulls is also to be found in Philadelphia. Imagine a series of six hundred skulls, mostly Indian, of all the tribes who now inhabit or formerly inhabited America. Nothing like it exists elsewhere. This collection alone is worth a journey to America. Dr. Morton has had the kindness to give me a copy of his great illustrated work representing all the types of his collection.[98]

In a separate letter, Agassiz continues:

> I would mention Dr. Morton, of Philadelphia, well known as the author of several papers upon fossils, and still better by his great work upon the indigenous races of America. He is a man of science in the best sense; admirable both as regards his knowledge and his activity. He is the pillar of the Philadelphia Academy.[99]

The "great illustrated work" to which Agassiz refers was Morton's epitome of his entire skull collection which appeared in 1849. Dr. Morton previously published two books, *Crania Americana* (1839) and *Crania Aegypticus* (1844) after his studies of hundreds of human skulls, which he began collecting in 1820. The research aimed to prove that races could be categorized and ranked objectively according to skull volume. He filled the skulls with lead shot, and then transferred the shot to graduated cylinders, making relatively accurate assessments which were recorded into tables published directly into the work. Morton's influence and his burgeoning theories on separate creations certainly helped to clarify Agassiz's beliefs. Together, theorist and analyst set forth the theories of polygeny.

Writing in the *Christian Examiner* in 1850, Agassiz polished these theories. Morton, who's skull collections won polygeny world-wide respect, went as far as to reject Buffon's criteria for species (based on interfertility). Agassiz capitalized on Morton's views, and in the article, he defined species as physically unique groups occupying definite, non-overlapping geographic areas. Agassiz supposed them to remain within these discrete geographic ranges, and display very little populational variance with time. Mankind, he surmised, through ingenuity and progress, overcame this geographic isolation to some degree, but must have been created in "that numeric harmony which is characteristic of each species; men must have originated in nations, as the bees have originated in swarms."[100]

Another factor contributing to the theory of polygenism was Louis Agassiz's affiliation with Dr. Samuel Morton, a Philadelphia doctor and [illegible] of human skulls. Agassiz described his interaction with Morton:

> Dr. Morton's unique collection of human skulls is alone worth a journey to Philadelphia. Imagine a series of six hundred skulls, most of them Indian, from all the tribes who now inhabit or formerly inhabited all America. Nothing like it exists elsewhere. This collection alone is worth a journey to America. Dr. Morton has had the kindness to give me a copy of his great illustrated work representing all the types of his collection.

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Writing to the [illegible] Morton, which skull collections were polygenism [illegible] reject Buffon's criteria for species (based on interbreeding). Agassiz [illegible] Morton's views, and in his article [illegible] compelling [illegible] remain within these discrete geographic ranges [illegible] variation with time. Mankind, he [illegible] overcome this geographic isolation [illegible] "That remark harmony which is [illegible] originated in nations, as the [illegible]

Gould points out that Agassiz's paper is "typical of its genre--advocacy of social policy crouched as a dispassionate inquiry into scientific fact." As part of the essay, Agassiz expounds upon the obligation to settle upon a relative rank of races. He utilized non-objective Caucasian stereotypes as a measure which put men of color at bottom of the ranking. He is careful not to cross the abolitionists, and vehemently defends the right to freedom of all men. This defense, however, is issued with the proviso that education should be tailored to the innate strengths of each race: "We entertain not the slightest doubt that human affairs with reference to the colored races would be far more judiciously conducted if, in our intercourse with them, we were guided by a full consciousness of the real difference existing between us and them, and a desire to foster those dispositions that are eminently marked in them, rather than by treating them on terms of equality."[101] Not surprisingly, Agassiz's "eminently marked dispositions" were submisiveness and imitation, rendering races of lower stature best for "work of the body".[102]

Louis Agassiz's personal contributions to polygeny were largely theoretical up to 1850; he provided no data to substantiate his hypothesis. However, in 1850 he traveled to South Carolina, and in the summer of 1851, he accepted a professorship at a medical college in Charleston. The opportunity to proctor a regular course of instruction to students and temporarily dispatch his erratic lecture schedule appealed to Agassiz; his health was poor at the time, and he welcomed the warm Southern clime. He established a laboratory on Sullivan's Island, where he intended to continue work on projects which he started previously toward establishing a basis for the comparison of the fauna along the entire Atlantic coast of the United States.

While in Charleston, Agassiz and his family frequented "Hollow Tree", an exquisitely picturesque country home belonging to Dr. John E. Holbrook and his wife (a woman with "rare mental qualities, which had been developed by an unusually complete and efficient education"):

> The days, passed almost wholly in the woods or on the veranda, closed with evenings spent not infrequently in discussions upon the scientific ideas and theories of the day, carried often beyond the region of demonstrated facts into that of speculative thought. An ever-recurring topic was that of the origin of the human race. It was Agassiz's declared belief that man had sprung not from a common stock, but from various centres, and that the original circumscription of these primordial groups of the human family corresponded in a large and general way with the distribution of the animals and their combination into faunae.[103]

Fig. 345.[559]

Orang-Outan.

Fig. 346.[561]

Hottentot Wagoner — Caffre War.

Fig. 347.[560]

Chimpanzee.

Fig. 348.[562]

Hottentot from Somerset.

Fig. 349.

Mobile Negro, 1853.

Fig. 350.

Mobile Negro, 1853.

Fig. 351.

Negro, 3200 years old [*supra*, pp. 250–251].

Fig. 352.

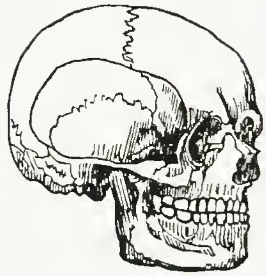
Nubian, 3200 years old.

(459)

Three pages from Nott and Gliddon's Types of Mankind (1855) attempt to illustrate the "obvious" similarities between Negroes and apes. Pages 85, 458-59.

Fig. 339. — Apollo Belvidere.[553]

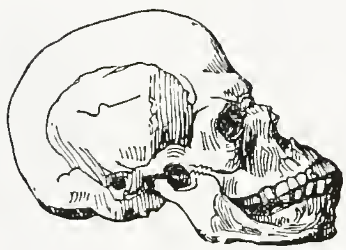
Fig. 340.[556]



Greek.

Fig. 341. — Negro.[554]

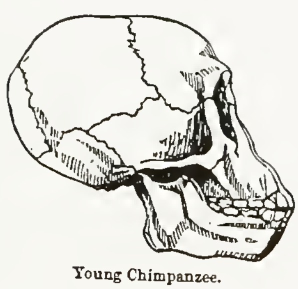
Fig. 342.[357]



Creole Negro.

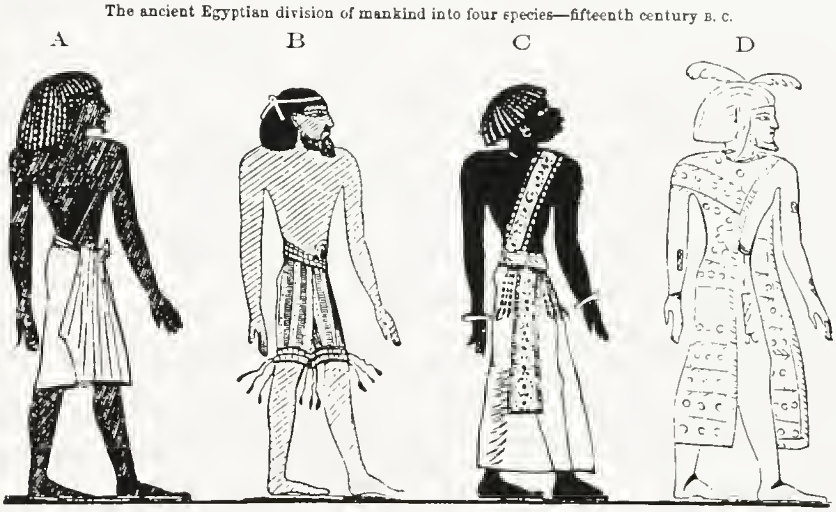
Fig. 343. — Young Chimpanzee.[555]

Fig. 344.[558]



Young Chimpanzee.

Fig. 1.
The ancient Egyptian division of mankind into four species—fifteenth century B. C.



Red. Yellow. Black. White.

During his year in South Carolina, he was grossly preoccupied with his zoological studies, but Agassiz did manage to follow a thin line of investigation on the "race question" with a Dr. Robert W. Gibbes, a noted ornithologist and collector of specimens from Columbia. The pair Hired J.T. Zealy, a daguerreotypist to photograph African-born slaves and their first generation offspring to study their anatomic features. Agassiz hoped his field research on these characteristics, supported by daguerreotypes, would buttress Morton's work with human skulls.[104]

Morton died during 1851, leaving the charge of polygeny to Agassiz. By virtue of his position at Harvard, and through his contacts with the intellectual and social elite, Dr. Agassiz assumed a prominent role on issues of race. In 1854, he wrote an essay appearing in Nott and Gliddon's *Types of Mankind* promulgating polygenic theories. The book, again typical of the genre, expounds at length upon the hierarchy of races--with "unsubtle attempts to suggest strong affinity between Africans and Gorillas." Illustrations abound; many are characatures presented as realistic drawings which are falsely exaggerated to more effectively amalgamate the species.[105]

The work of Agassiz, Morton, Nott and Gliddon can not be dismissed as peripheral to the modicum of thought in the United States prior to the Civil War. In fact, the men were all technically abolitionists. The social climate which provided for the abolition of slavery in the late nineteenth century certainly did not do so with the acceptance nor hope for integration of African populations. Dr. Agassiz's writing to 1854, and Nott and Gliddon's *Types of Mankind* provide extremely important clues that the theories of creationism were crumbling in the face of "evidence" collected regarding the races. Indeed, Josiah Nott clearly stated his intent in the tome--to set free the natural history of mankind from Biblical doctrine. Clearly in the foreshadow of Darwin, the scientific community prepared itself for a change in paradigm. The scientists issued the theories of "separate creations" and polygeny much as Tycho Brahe utilized his *epicycles* in the sixteenth century--a necessary but futile attempt to explain observed phenomena and simultaneously preserve much of the existing social, political, and theological structure. The trial failed, but set the stage for Charles Darwin's 1859 publication of *Origin of Species*. The following passage appears at the end of Darwin's book; it tells us much about changing paradigms and the American school of polygeny:

> Although I am fully convinced of the truth of the views given in this volume... I by no means expect to convince experienced naturalists whose minds are stocked with a multitude of facts all viewed, during a course of years, from a point of view directly opposite to mine... [B]ut I look with confidence to the future, --to young and rising naturalists, who will be able to view both sides of the question with impartiality.[106]

Louis Agassiz, never able to fully accept Darwin's theories, slowly lost the scientific support for polygenic theory. Gould wrote of the last decade of his life: "He remained a hero to the public, but scientists began to regard him as a rigid and aging dogmatist, standing firm in his antiquated beliefs before the Darwinian tide."[107] He continued his career traveling, collecting, and teaching, retaining his strong separatist views on the roles of blacks in American society. Indeed, in 1863 he consulted for Dr. S.G. Howe, a committee member under Lincoln's Inquiry Commission on the role of the Negro in a reunited nation. Agassiz laments the establishment of a permanent population of African Americans, but issues the moral imperative to "look upon them as co-tennants in the possession of this part of the world."[108] He does warn against racial mixing, citing the creation of a mulatto population as "inconsistent with the progress of a higher civilization and a purer morality."[109] To the end of his life, Agassiz argued vehemently for social segregation. He reiterates, however, his opposition to slavery: "I do not mean to say that slavery is a necessary condition for the organization of the Negro race. Far from it. They are entitled to their freedom, to the regulation of their own destiny, to the enjoyment of their life, of their earnings, of their family circle."[110]

Agassiz held fast to his views on separate creations, opposing to the end of his life Darwin's inference that higher forms evolved from lower ones. His final article, "Evolution and Permanence of Type" (1873), was to begin a series published in the *Atlantic Monthly*. In it, Agassiz makes a retort to (Darwin's) "favorite theory", indicating that in his future articles Agassiz intended to "show, first, that , however broken the geological record may be, there is a complete sequence in many parts of it, from which the character of the succession may be ascertained; secondly, that...there is no evidence of a direct descent of later from earlier species in the geological succession of animals." Dr. Agassiz passed away in 1873, before he had the opportunity to deliver his proof. This final article contains a quote which characterized perfectly Agassiz's role throughout the change of paradigms: "A physical fact is as sacred as a moral principle. Our own nature demands from us

this double allegiance."[111] With Darwin's theories in seed, the American school of polygeny expired with Dr. Agassiz.

In 1977, Stephen Jay Gould began a reanalysis of data sets in craniometry and intellegence testing for his book, *The Mismeasure of Man.* Gould postulated that the science contributing to theories of biological determinism might have been dependent upon cultural influences. He looked to find social biases in the "classical" data sets that substantiated these theories. Gould reasoned that one of two situations existed: either inductive, objective science added legitimate data to strengthen determinist arguments, or *a priori* convictions fashioned the scientific queries and results.[112] He utilized Morton's collections of human skulls, which survive to this day, and repeated Morton's study within the context of a modern scientific and statistical method. Gould summarized the results of his analysis:

> In short, and to put it bluntly, Morton's summaries are a patchwork of fudging and finagling in the clear interest of controlling a priori convictions. Yet--and this is the most intriguing aspect of the case--I find no evidence of conscious fraud; indeed, had Morton been a conscious fudger, he would not have published his data so openly.[113]

Essentially, Gould found that Morton created error in at least four categories:
1. He shifted criteria and allowed for favorable inconsistencies. Much of his bias stemmed from his inclusion or deletion of large subset groups during his skull volume studies. This allowed group averages to match his preconceptions. Herein lies the most flagrant bias in Morton's study. When compiling data sets for *Crania Americana,* he generously overrepresented Peruvian skulls, which comprised 25% of his sample. Skulls from the relatively large-skulled Iroquois make up only 2% of the samples. In concert, Morton consciously omitted more than three Hindu skulls into his Caucasian measurements, "because the skulls of these people are probably smaller than those of any other existing nation."[114] Measurements for *Crania Aegyptiaca* turned out to be even more dubious. Morton worked with skulls secured from mummified remains and tombs, and where sex or creed were not apparent, Morton himself racially assigned the skulls prior to making his measurements, certainly using size and appearance as criteria.
2. His measurements were subjective, and always directed toward his prejudices. Morton began his experimentation using seed, which gave results imprecise enough to give subjective leeway. When he eventually switched to lead shot, the

this double allegiance.[138] With Darwin's theories in need, the American school of polygeny married with Dr. Agassiz.

In 1977, Stephen Jay Gould began a reanalysis of data used in craniometry and intelligence testing for his book, *The Mismeasure of Man*. Gould recognized that the science contributing to theories of biological determinism might have been dependent upon cultural influences. He looked to find causal biases in the "classical" data sets that substantiated these theories. Gould examined data sets of two situations studied: either inductive, where scientists utilized legitimate data to strengthen deterministic arguments, or *a priori* convictions compromised the scientific queries and results.[139] He utilized Morton's collection of human skulls, which survive to this day, and reassessed Morton's study within the context of a modern scientific and statistical method. Gould summarized the results of his analysis:

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Essentially, Gould found that Morton created error in at least four categories: 1. He shifted criteria and allowed for favorable inconsistencies. Most of his bias stemmed from his inclusion or deletion of large subset groups during his skull volume studies. This allowed group averages to match his preconceptions. Due to the most flagrant bias in Morton's study, when compiling data on the Native Americans, he generously overrepresented Peruvian skulls (which comprised 25% of his sample. Skulls from the relatively large Iroquois were making up only 2% of the samples. In contrast, Morton consciously omitted more than three Hindu skulls into his Caucasian measurements, "because the skulls of these people are probably smaller than those of any other existing nation".[141] His conversion for Grecian-Egyptians turned out to be even more damning. Morton omitted such skulls secured from mummified remains and tombs, and when means would not appear, Morton himself partially assigned the skulls according to his measurements, certainly using size and shape as determinants. 2. His measurements were subjective and sloppy. Morton began his measurements using seed, which permitted much to give subjective leeway. When he eventually switched to lead shot

measurements were more objective, but errors detected by Gould while reproducing the experiments had always worked against blacks and Indians in Morton's data sets.

3. Morton made flagrant procedural omissions which now seem obvious. The most obvious example of this lies in the fact that Morton did not account for sex or stature when comparing the skull volumes.

4. Finally, Morton made miscalculations and convenient omissions of "outlyers" which always fell to the favor of his expected results. Again, it is unlikely that this was consciously intentional, but he surely never re-checked results when they complied with his expected results.

Agassiz's was always more a theorist than empiricist; his daguerreotypes stood as his only physical contribution to polygenic theory. In 1976, fifteen of the original daguerreotypes were discovered at Harvard's Peabody Museum of Archaeology and Ethnology by Elinor Reichlin, then a researcher there. Over a century old, the daguerreotypes now assume a degree of relative importance in the history of science, photography, and archaeology. The images portray African-American slaves: men and women in standing frontal, lateral, and posterior views. While they illustrate the early application of the photographic technique to scientific pursuits, perhaps the more striking aspect of their importance lies in the fact that they are the earliest surviving photographic images of slaves in America. When Zealy took the photographs in March of 1850, daguerreotypy was a difficult, time-consuming, and relatively expensive process. In the social context of the day, few persons would have spared the expense to photograph a person of color.

With Agassiz and Morton, we see again the physical products of science offering contributions to modern science and history which could never have been perceived. Morton's data, previously published in its entirety, buttressed an existing notion that blacks and Indians held a lower role in society. The guidance of social policy vindicated through "scientific" substantiation of racial bias was clearly illustrated through Morton's work, and particularly by Dr. Agassiz's influence on S. G. Howe, consultant to Abraham Lincoln. Stephen Jay Gould researched the propulsion of pre-determinist theories and scales through science--a science that is consciously, unconsciously, and helplessly bound to social constructs. From a literal viewpoint, Gould could not have re-evaluated Morton's studies had his collection of skulls and data been allowed to perish. It is somewhat ironic and culturally

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reassuring that Gould's reanalysis absolves Morton and Agassiz to a great degree. In their day, they lacked the statistical sophistication and could not have had the social prescience to conform to contemporary views on race, prejudice, and the conduction of science. Within our social paradigm, one may immediately look to their views as racist and unfounded, but closer examination of the political and cultural construct within which they functioned portrays the men as legitimate scientists struggling to make sense of their world through observation. Indeed, the "racist" physical data collected by these scientists, particularly Morton's collection of skulls, holds value for contemporary research. Agassiz's daguerreotypes provide for us a riveting visual testament to the lives of African men an women brought to or born into the United States as slaves.

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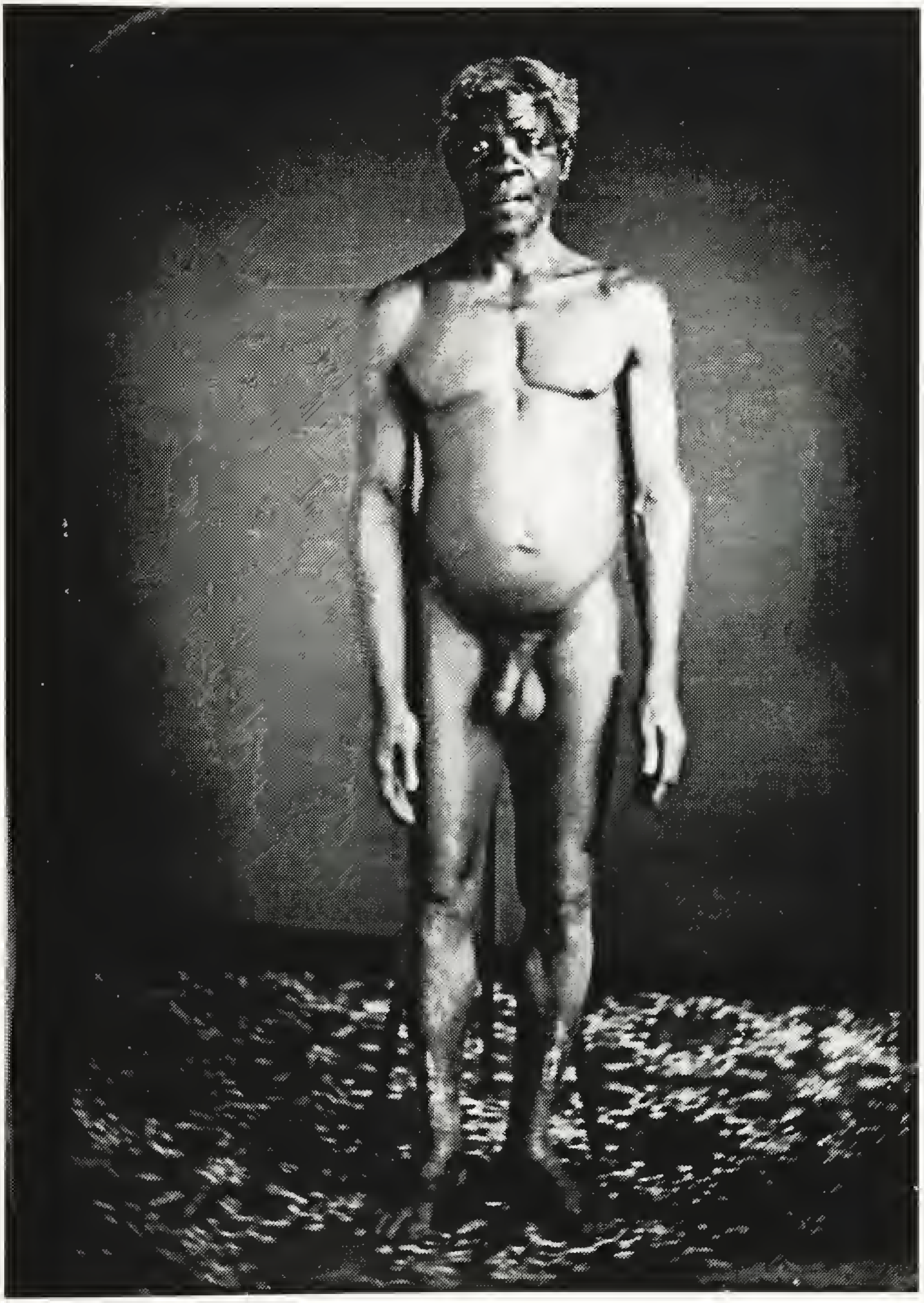
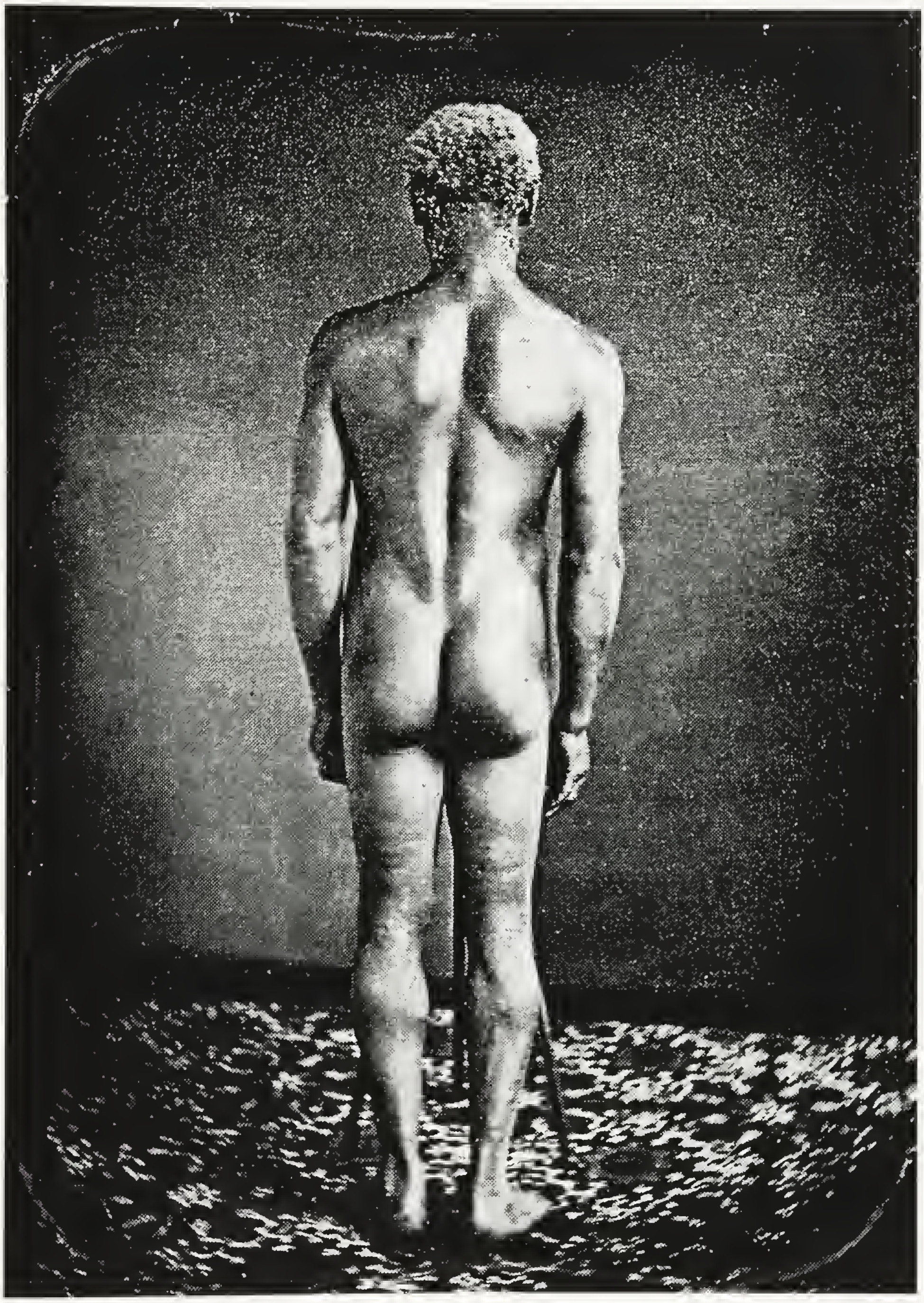


Agassiz's daguerreotype of "Jem, Gullah, belonging to F.N. Green, Columbia, South Carolina." J.T. Zealy, March 1850. Courtesy of the Peabody Museum of Archaeology and Ethnology, Harvard University.

Agassiz's daguerreotype of "Jem, Gullah, belonging to F.W. Green, Columbia, South Carolina," J.T. Zealy, March 1850. Courtesy of the Peabody Museum of Archaeology and Ethnology, Harvard University.

Agassiz's daguerreotype of "Jem, Gullah, belonging to F.N. Green, Columbia, South Carolina." J.T. Zealy, March 1850. Courtesy of the Peabody Museum of Archaeology and Ethnology, Harvard University.

Agassiz's daguerreotype of "Alfred, Foulah, belonging to I. Lomax, Columbia, South Carolina." J.T. Zealy, March 1850. Courtesy of the Peabody Museum of Archaeology and Ethnology, Harvard University.



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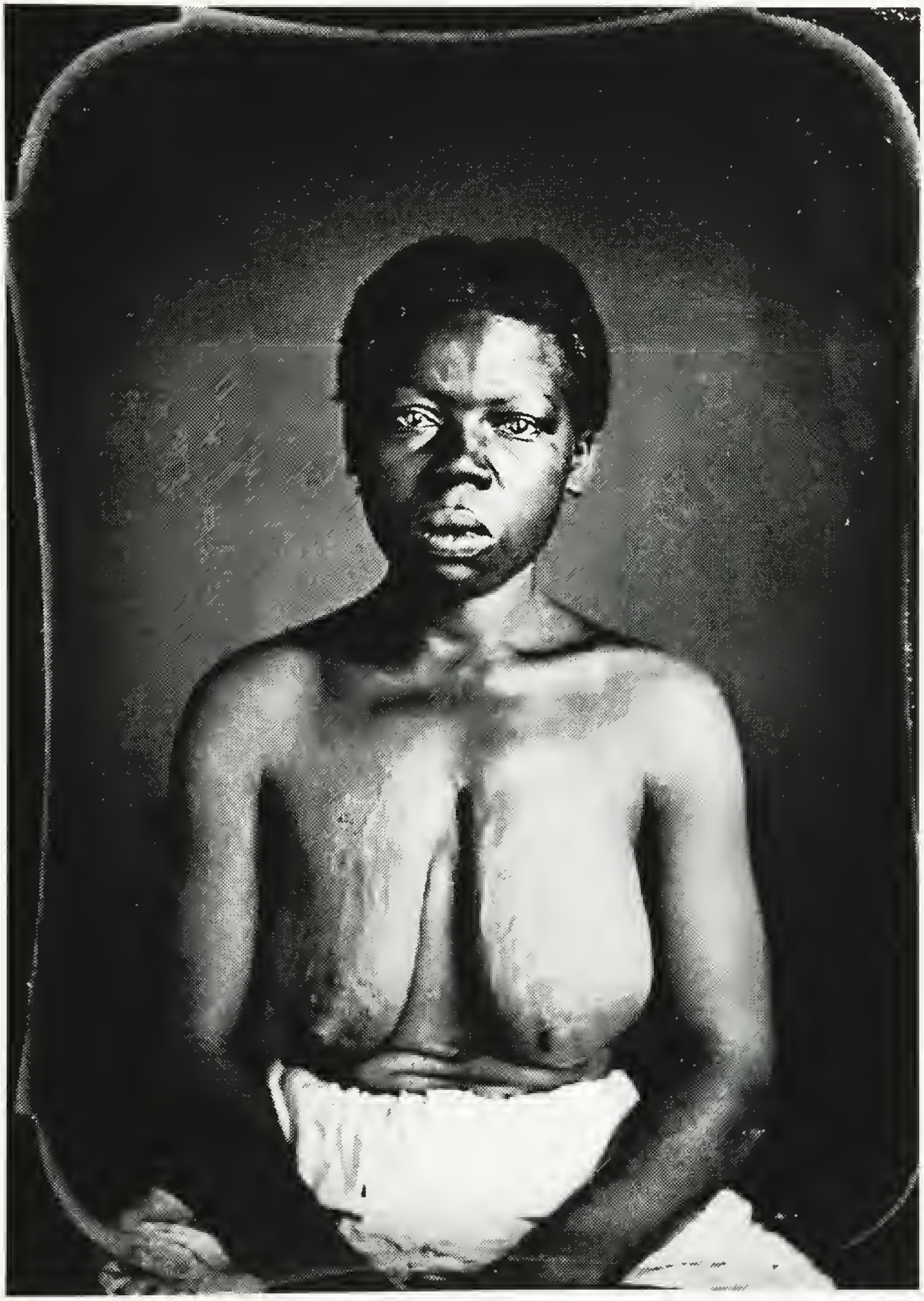

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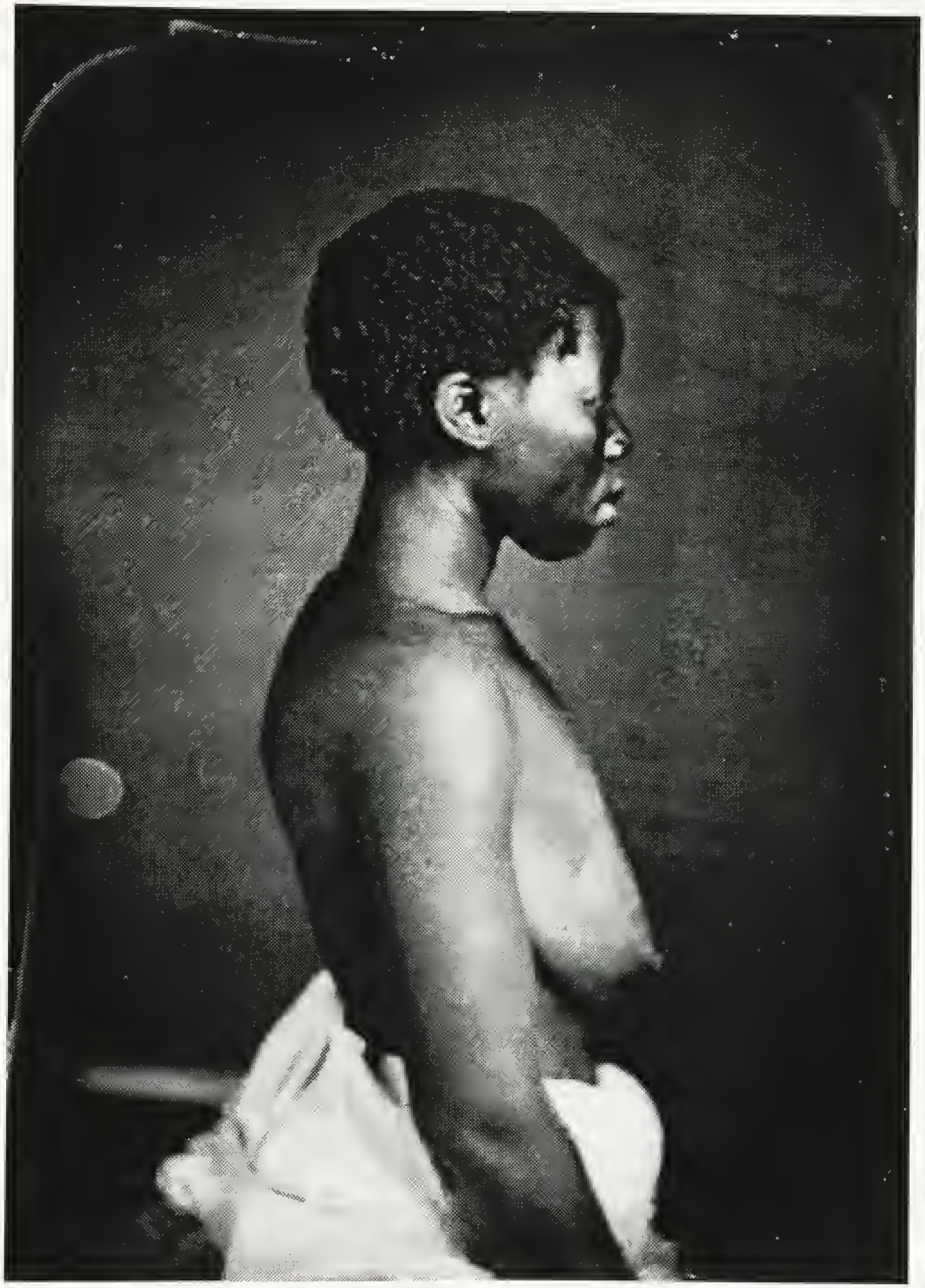

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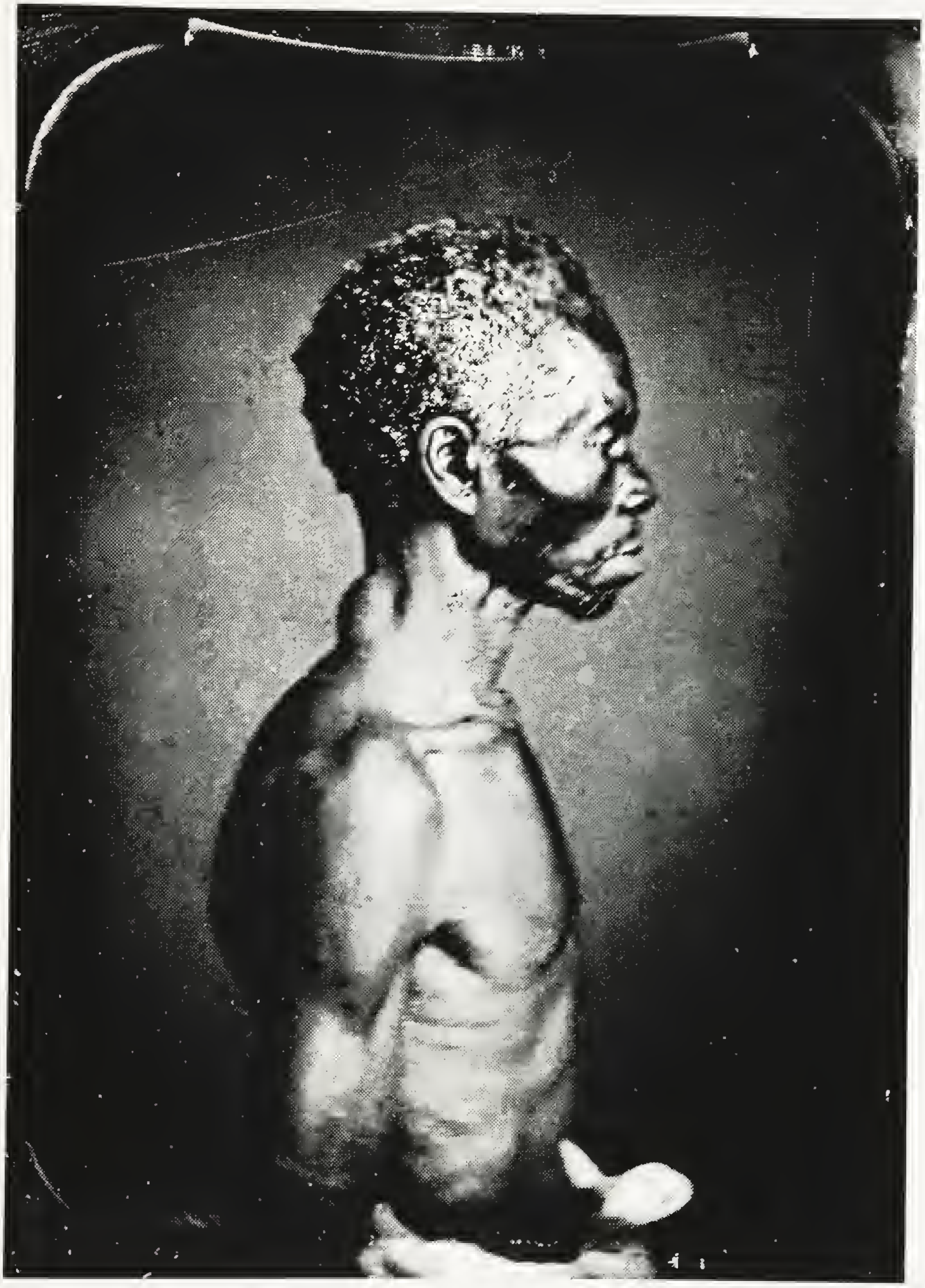

Agassiz's daguerreotype of "Rentu. Congo. On plantation of B.F. Taylor, Columbia, South Carolina." J.T. Zealy, March 1850. Courtesy of the Peabody Museum of Archaeology and Ethnology, Harvard University.

Agassiz's daguerreotype of "Renty, [illegible]" [illegible] Carolina." J.T. Zealy, March 1850. Courtesy of the [illegible] Ethnology, Harvard University.

W.H. Sheldon and Constitutional Psychology: Prometheus to Posture Photographs

It is only an error of judgment to make a mistake, but it argues an infirmity of character to adhere to it when discovered.
--C.N. Bovee

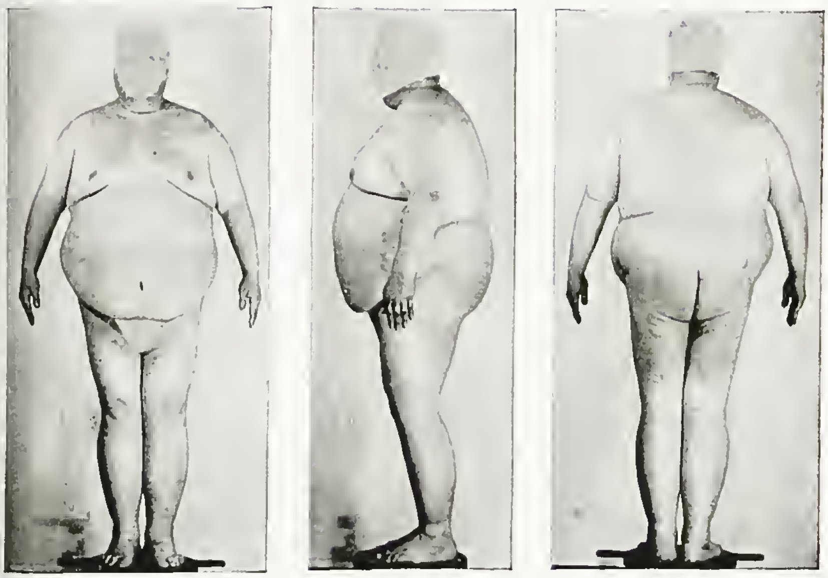

FIG. 93. A 711 in full blossom. Age 42, height 72.8 in., weight 400 lbs.

Figure from Dr. W.H. Sheldon's *Varieties of Human Physique* (1940) showing the prototypical endomorphic physique.

The concept of morphology as the major contributor to biological determinism certainly did not fade with Agassiz and Morton's polygenic precepts. Darwin's theories of evolution could account for observed differences in the constitutions of individuals and races subjected to the various environmental selection pressures, but the theories could not escape the rhetorical implications that society would invariably draw from them. Indeed, the very notion of a "survival of the fittest" ushered conceit to members of every privileged class. If anything, Darwin inadvertently did more to foster racist and classist thought than he could have intended.

With the determination of "fitness" safely relegated to the gene, scientists (still bound to their cultural biases) began a crusade to arbitrarily identify, define, and refine traits which were desirable--those which are selected. This trend worked its way from between races and cultures, ultimately turning inward to stratify members within groups. W.H. Sheldon provides the final example of an observational collection generated in the pursuit of theory.

William H. Sheldon, as part of his doctoral dissertation at the University of Chicago in 1926, published "Morphologic Types and Mental Ability". The work gave indication to the research the psychologist would pursue to the end of his life. A decade later, Sheldon defined his intentions in his book *Psychology and the Promethian Will* (Harpers, 1936). He optimistically proposes that psychology could become a legitimate science if only it would:

> ...bring system and order into the description of basic differences among human beings...the first task of psychology seems to be that of standardizing a method for describing quantitatively the varying physical endowments of individuals...[a] descriptive classification of the behaving structure: the physical constitution.[115]

Dr. Sheldon set out to produce a description and classification schema at the level of human morphology. Sheldon questioned the wisdom behind the study of mental functions in isolation from morphology, morphology in isolation from physiological processes, and physiology in isolation from mental processes.[116] His idea was to conceive of an objective frame of reference--a schema for depicting formal interrelations based on significant, objectively-measured morphological variables. Using the objective morphological frame of reference, Sheldon hoped eventually to be able to draw correlations between a persons physical constitution and other psychological, temperamental, social, and medical variables.

Clearly Dr. Sheldon was not the first to attempt to conceive of a morphological classification system. *Varieties of Human Physique*, Sheldon's flagship treatise, traces the history of early anthropomorphic attempts from Hippocrates' designation of the *phthisic habitus* and *apoplectic habitus*, to the Frenchman Halle, who in 1797 popularized the divisions of *type digestif, type musculaire*, and *type cerebral.* Rostan's 1828 treatise *Cours Elementaire d'Hygiene* utilized Halle's terminology. Gall and Spurzheim, French anatomists contemporary with Rostan, were strongly influenced by his work; they embraced Rostan's

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conceptions of human constitution when they founded phrenology. Sheldon wrote of his predecessors (the ironic criticism foreshadowed his own scientific flaws):

> Clearly the phrenologists and characterologists of seventy years ago had the rudiments of a plan in mind. They were applying the cumulative wisdom of observation in a fairly systemic manner, but their system leaned heavily upon subjective judgment. Nevertheless, within its limits the scheme worked.[117]

TABLE 1

CLASSIFICATIONS OF CONSTITUTIONAL TYPES

Source	*Nationality*	*1*	*2*	*3a*	*3*	*3b*
Hippocrates (460- o B.C.)	Greek	Habitus apoplecticus (short, thick)			Habitus phthisicus (long, thin)	
Hslle (1 ·7)	French	Abdominal	Muscular	Thoracic		Nervous, cephalic
de Trois evre (1821)	French	Abdominal		Thoracic		Cranial
Rostan (1828)	French	Digestive	Muscular	Respiratory		Cerebral
Walker (1852)	English	Nutritive beauty (Venus)	Locomotive beauty (Diana)			Mental beauty (Minerva)
Carus (1852)	German	Phlegmatic	Athletic	Asthenic		Cerebral
Wells (1869)	American	Vital	Motive		Mental	
di Giovanni (1877)	Italian	Third combination	Second combinstion (Plethoric)		First combination (Phthisic)	
Beneke (1878)	German	Rachitic	Csrcinomatous		Scrofulous, phthisical	
" -Rokitansky (1878)	German	Hyperplastic	Normal		Hypoplastic	
Huter (1880)	German	Ernährungstypus	Krafttypus		Empfindungstypus	
Manouvrier (1902)	French	Brachyskeletal (Microskeletal)	Mesoskeletal		Macroskeletal	
Stratz (1904)	German	Xantodermic (Racial)	Leucodermic (Racial)		Melanodermic (Racial)	
Virenius (1904)	Russian	Connective	Muscular	Epithelial		Nervous
Sigaud (1908)	French	Digestive	Muscular	Respiratory		Cerebral
Bean (1912)	American	Hypo-onto-morph (Hypo-phylo-morph)	Meso-onto-morph (Meso-phylo-morph)		Hyper-onto-morph (Hyper-phylo-morph)	
Bryant and Goldthwait (1915)	American	Herbivorous	Mesoplastic (Normal)		Carnivorous	
Mills (1917)	American	Hypersthenic	Sthenic		Asthenic (Hyposthenic)	
Brugsch (1916)	German	Wide chested	Normal chested		Narrow chested (Asthmatic)	
Viola (1919)	Italian	Megalosplanchnic (Macrosplanchnic)	Normosplanchnic		Microsplanchnic	
Davenport (1923)	American	Fleshy biotype	Medium biotype		Slender biotype	
Stockard (1923)	American	Lateral	Intermediate (Normal)		Linear	
Aschner (1924)	German	Broad	Normal		Slender	
Bsuer, J. (1924)	Austrian	Hypersthenic habitus (Arthritic habitus)	Sthenic habitus		Asthenic habitus	
Draper (1925)	American	Gallbladder			Ulcer	
Kretschmer (1925)	German	Pyknic	Athletic		Leptosome (Asthenic)	
MacAuliffe (1925)	French	Round			Flat	
Weidenreich (1926)	German	Eurysome			Leptosome	
Pende (1927)	Italian	Hypervegetative			Hypovegetative	

Sheldon's table characterizing historical attempts at establishing an objective human constitutional morphology. From *Varieties of Human Physique*, p. 22.

In his review, Sheldon commented on the efforts of theorists more contemporary to himself. Viola, an understudy of di Giovanni (the founder of Padua's school of clinical anthropology), took into account di Giovanni's work, and went on to define another three-tiered system of morphological classification based on various limb and torso length ratios. He called these the *microsplanchnic*, *macrosplanchnic*, and *normosplanchnic* types. Viola's major contribution, however, lay in that he established objective measuremental criteria and included statistical

conceptions of human constitution when they founded phrenology. Sheldon wrote of his predecessors (the major criticism foreshadowed his own scientific theory):

> Clearly the phrenologists and characterologists of seventy years ago saw the rudiments of a plan to build. They were applying the descriptive method of observation in a fairly systematic manner, but their evidence rested heavily upon subjective judgment. Nevertheless, within its limits the science worked.[17]

Sheldon's table characterizing his predecessors' attempts at establishing an objective human constitutional morphology. From *Varieties of Human Physique*, p. 32

In his review, Sheldon commented on the efforts of Charcot's more contemporary to himself. Viola, an anatomist who founded the Italian school of clinical anthropology, took into account all of his predecessors' work, and went on to define three general types of morphological classification based on various limb and trunk-length ratios. He called these the microsplanchnic, macrosplanchnic, and normosplanchnic types. Viola's major contribution, however, lay in that he established objective measurement criteria and included standard

methods in his analysis. In Viola's first major study of 400 subjects, he found that 24% of his subjects were microsplanchnic, 48% normosplanchnic, and 28% macrosplanchnic--a nearly perfect distribution along the Bell curve.

Sante Naccarati, a Columbia student and former pupil of Viola, studied with diligence the work of previous anthropologists. In 1920, Naccarati attempted to make correlations between physical measurements and "intellegence". The results appeared in the Archives of Psychology (no. 45 (Aug.) 1921) under the title "The morphologic aspect of intelligence", and similar correlations were drawn with temperament.[118] The correlations were invariably low, but often indicated that a positive correlation might exist between "preponderance of vertical measurements and mental ability", and a low negative correlation between "lateral or horizontal preponderance and mental ability."[119] Apparently the correlations were just strong enough to convince Naccarati that a true relationship existed; he attributed the dismal results to inarticulate morphological system of classification.

Sheldon, who worked with Sante Naccarati at Columbia, set out to repeat his experiments utilizing larger numbers while at the University of Chicago in 1927.[120] He found a correlation coefficient of +0.14 between morphologies and psychological testing, and +0.12 for morphologies and their relationship to grades. The results proved to be lower than Naccarati's original coefficients. Sheldon was frustrated by the fact that efforts to strengthen the correlations by separating psychological tests or grades into subsections failed. He was not alone, attempts to find a predictive relationship between body type and performance were widespread by many scientists--they were "uniformly disappointing".[121] Sheldon, like Naccarati before him, attributed the poor correlations to an inexact system of morphological classification.

Utilizing newly-developed and popular rating scales for measuring social characteristics, Sheldon delved further into the problem. He petitioned older members of fraternities at the University of Chicago and trained them to secretly evaluate younger members for sociability, perseverance, leadership, aggressiveness, and emotional excitability. Sheldon and his colleagues then took detailed morphological indices of the younger members, and again attempted to establish a relationship between body parameters and psychological traits. Persistent low correlations surfaced, with the conclusion that aggressiveness, leadership, and sociability clustered weakly with the general factor of "bigness or heaviness".[122] However, careful analysis failed to reveal a reliable source of the occasional low correlations.

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Utilizing newly-developed and popular rating scales for measuring social characteristics, Sheldon delved further into the problem. He enlisted older members of fraternities at the University of Chicago and Harvard Medical School to evaluate younger members for aesthetic, personality, leadership, social affairs, and emotional excitability. Sheldon and his colleagues then took detailed morphological indices of the younger members, and again attempted to establish a relationship between body parameters and personality traits. The results showed low correlations overall, with the conclusion that aggressiveness, leadership, and sociability clustered weakly with the general factor of "bodily massiveness".[20] However, careful analysis failed to reveal a reliable source of the occasional low correlations.

Remarkably, Dr. Sheldon still refused to attribute the low correlations to bias, or to accept a null hypothesis. He attempted next to standardize even more rigidly his measurements: for the first time employing the photographic method and using a special swivel chair equipped to hold the subjects at a fixed distance from the camera. Sheldon repeated his experiment again, and remained unable to isolate physical factors which could be reliably correlated with temperament. He summarized his findings: "These results were certainly not heartening. We had gone a step beyond the work of predecessors and had demonstrated only too clearly that further progress on this particular trail alone could but complicate and obscure the picture."[123]

From the beginning, Sheldon (and his contemporaries) walked a dangerously close line to eugenic thought. A 1924 study by Sheldon, "The Intellegence of Mexican Children" reportedly makes damming assertions about the intellegence testing in minorities--a report undoubtedly ripe with bias and racism. However, one must don the perspective of the early twenties prior to making moral judgment on Sheldon and his work. Such theories thrived among trained psychologists at this time. In fairness to Dr. Sheldon, he did account early on for the role of the environment in his constitutional theory: "We mean by constitution the basic, underlying pattern of the living individual, as it is at the time when the individual is studied. That constitution is closely determined by heredity is highly probable, but we do not know that it is entirely so determined."[124]

However, even some of Dr. Sheldon's contemporaries began to question the scientific virtue of continued studies attempting to correlate physical traits with social, temperamental, and psychiatric ones. In his 1930 book *Physique and Intellect* (Century Psychology Series. New York: D. Appleton-Century), D.G. Paterson published his conclusions regarding the research done in the field to date: "Search in the realm of gross anatomy for a physical correlate of intellect has yielded uniformly negative results." Paterson's review confirmed that height, weight, measurements of head size and shape, skeletal development by X-rays, dentition, physiological development in terms of pubescence, and complicated morphological indices were all dismally correlated or not correlated at all to intellegence. This was true even when "intellegence" could be very narrowly defined.[125]

Sheldon immediately took issue with Paterson's criticism. The psychologist defended himself, and particularly the work of the German psychiatrist Kretschmer, who had published observations linking his psychiatric patients'

disease processes with morphological variables. Kretschmer's system, an "objective" three-tier classification adopted from the French, allowed the psychiatrist to indicate that most of his bipolar patients fell into a macrosplanchnic category, while his schizophrenic ones tended toward microsplanchny. Paterson argued that Kretschmer's complicated system allowed for too much variability in patient assignment, leading to bias. Sheldon resolves the conflict with an ironic dismissal:

> This somewhat impatient reaction of a well-trained scientific mind to what is , nevertheless, perhaps a brilliant advance in the field of constitutional study, illustrates the conflict between a creative and a logical kind of thinking...With Kretschmer, insight and an observant eye came first, tools of quantification were to be applied later. Paterson, critical and accurate in the use of scientific tools, could not tolerate their careless handling, a fault of which Kretschmer is undoubtedly guilty.[126]

Paterson's criticism, and primarily Kretschmer's book, *Korperbau und Charakter*, only fueled Dr. Sheldon's resolve to find an equitable, objective morphological measure which could be correlated to psychiatric, psychological, and intellegence characteristics. He began from scratch, and again utilizing his photographic methods to maintain objectivity, he set out to find physical characteristics which could be objectively quantified. With this study, Sheldon would for the time abandon attempts at correlation, seeking first to establish an objective, reliable scale to evaluate physique.

The results of the endeavor appeared in 1940 with W.H. Sheldon's treatise *The Varieties of Human Physique: An Introduction to Constitutional Psychology.* By this time, Sheldon was a professor at Harvard, and he worked in collaboration with another Ph.D., S.S. Stephens (also at Harvard) and W.B. Tucker, an M.D. at the University of Chicago. The three pooled 4000 students from midwestern and eastern universities. They chose to include only individuals of Caucasian descent, ages ranging from 16 to 20, with the mean age at 18 years, 3 months. Each student was photographed standing, in the nude, in the frontal, lateral, and posterior plane with an apparatus which swiveled, and held the subject at a fixed distance from the camera. From the series, "extreme examples of each of three pronounced variants" became apparent.[127] These three contributing components were defined as somatotypes: *Endomorphy*, *Mesomorphy*, and *Ectomorphy*.

Endomorphy Sheldon defined as a

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Endomorphy Sheldon defined as a

> ...relative predominance of soft roundness throughout the various regions of the body. When endomorphy is dominant the digestive viscera are massive and tend relatively to dominate the bodily economy. The digestive viscera are derived principally from the endodermal embryonic layer...Our extremes of type 1 are not compact, but are round and soft. They are made of loose, flabby tissue. They float in water, and are markedly lacking in strength. Their bones are small, and their bodies are of relatively low density. Such people are physically weak.[128]

Mesomorphy Sheldon indicated

> ...means relative predominance of muscle, bone, and connective tissue. The mesomorphic physique is normally heavy, hard, and rectangular in outline. Bone and muscle are prominent and the skin is made thick by a heavy underlying connective tissue. The entire bodily economy is dominated, relatively , by tissues derived from the mesodermal embryonic layer...Our extremes of type 2 are not always athletic. They are massive, solid people with large bones, big joints, and heavy muscles. These variants are actually more compact than are the extremes of type 1. Sometimes they are slow of movement, awkward, and "muscle bound".[129]

Ectomorphy, then

> ...means relative predominance of linearity and fragility. In proportion to his mass, the ectomorph has the greatest surface area and hence relatively the greatest sensory exposure to the outside world. Relative to his mass he also has the largest brain and central nervous system. In a sense, therefore, his bodily economy is relatively dominated by tissues derived from the ectodermal embryonic layer...Extremes of type 3 are often singularly spry. Despite their slender limbs and bodies, they are not infrequently good at minor athletics, and they are often great walkers. Kretschmer's later term "leptosomic" (delicate bodied) describes reasonably well this third type of variant".[130]

Sheldon did not simply assign persons into the three groups; indeed he noted that each individual had some element of each type in his constitution, and often shared these different elements across different regions of the body. Sheldon defined 5 separate body regions, and in each subject described the relative strength of each of each characteristic across the regions. He then serially arranged the 4000 subjects according to their appearance. In his attempt to make a scale which maintained accuracy and sufficient depth, he devised a 7 point scale (1 being the least and 7 the greatest degree of any feature) and assigned each subject a three number "score" relating these features. As an example, a person who rated very high in endomorphy, but showed little mesomorphic or ectomorphic character could be

rated a 7-1-1. The rare but "classic" well-built athletic physique with low body fat ("built for combat" as Sheldon would point out) would score a 1-7-1, and the proverbial "98-pound-weakling", with large head and thin, lanky limbs would stand as the quintessential 1-1-7. The scales were sufficiently graduated to accurately describe any body type: a person who appeared to have excellent muscle development, but also displayed some degree of rotundity (endomorphy) might score a 4-6-1. Finally, to absolutely focus the scale, Dr. Sheldon employed a few other descriptive variables:

Dysplasia described a gross disharmony across any of the 5 regions in a single individual (i.e., a 98-pound-weakling with grossly muscle-bound legs).

Gynandromorphy referred to the bisexuality of a physique, also gauged on a 7-point scale.

Texture, not defined objectively, referred to the overall "fineness" or "coarseness" in appearance of a physique.

Finally, the degree of *hirsutism* was quantified, and with the entire scale, Sheldon set out to test his new instrument.

The Varieties of Human Physique introduces the concepts of constitutional psychology, covers the background, and then provides a small catalog of the common and striking somatotypes. Published with photographs are Sheldon's pseudo-objective, mildly-technical, unfounded and often comically baroque descriptions of the somatotypes. Dr. Sheldon writes:

> In the 711 the first component is at high tide, and neither muscularity nor ectomorphic interference shows through at any point. It is as though the whole body were "pneumatic" and gently and evenly inflated at low pressure...The 711 has a huge head...The neck is extremely short, as externally perceived, and the head may sit upon the torso like a pumpkin on a barrel...[131]
>
> ...The 362 is ideally adapted for professional athletics, but tends to put on weight too fast and is always bothered with the problem of "training." If he gets too much to eat, he can expand to an astonishing weight in middle life, but it will be a general expansion all over the body, not a local abdominal blowout...[132]
>
> The 442 is chubby. No other descriptive term fits him quite so well. Like all moderately endomorphic people, he has round, chubby cheeks and a ruddy pink color which in cold weather blossoms out to a brilliant red. He is stocky but not fat, sturdy but not blocky, and all his features tend to be blunt or "rubbery."...[133]

rated a 7-1-1. The rare but "classic" well-built athletic physique with low-body fat ("built for combat" as Sheldon would point out) would score a 1-7-1. And the proverbial "90-pound-weakling", with large head and thin, frail, limbs would stand as the quintessential 1-1-7. The scales were [illegible] graduated to accommodate describe any body type: a person who appeared to have excellent muscle-development, but also displayed some degree of unhealthy endomorphic weight gain gave a 4-6-1. Finally, to elaborately [illegible] from the scale, Dr. Sheldon introduced a few other descriptive variables.

Dysplasia described a gross disharmony, the mixing of these elements in a single individual (i.e., a 90-pound weakling with greatly muscle bound legs).

Gynandromorphy referred to the possession of a physique [illegible] also gauged on a 7-point scale.

Texture, not defined specifically, referred to the overall "fineness" or "coarseness" in appearance of a physique.

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The Varieties of Human Physique introduced the principles of constitutional psychology, covers the background, and then presents a small catalog of the common and striking somatotypes. Furnished with photographs, the [illegible] pseudo-objective, wildly [illegible], [illegible] and [illegible] descriptions of the somatotypes. Dr. Sheldon writes:

> In the 711 the first component is strongly predominant [illegible] endomorphic [illegible] whole body seems "overgrown" [illegible] pressure. The 711 has a [illegible] externally [illegible] a barrel...[illegible]

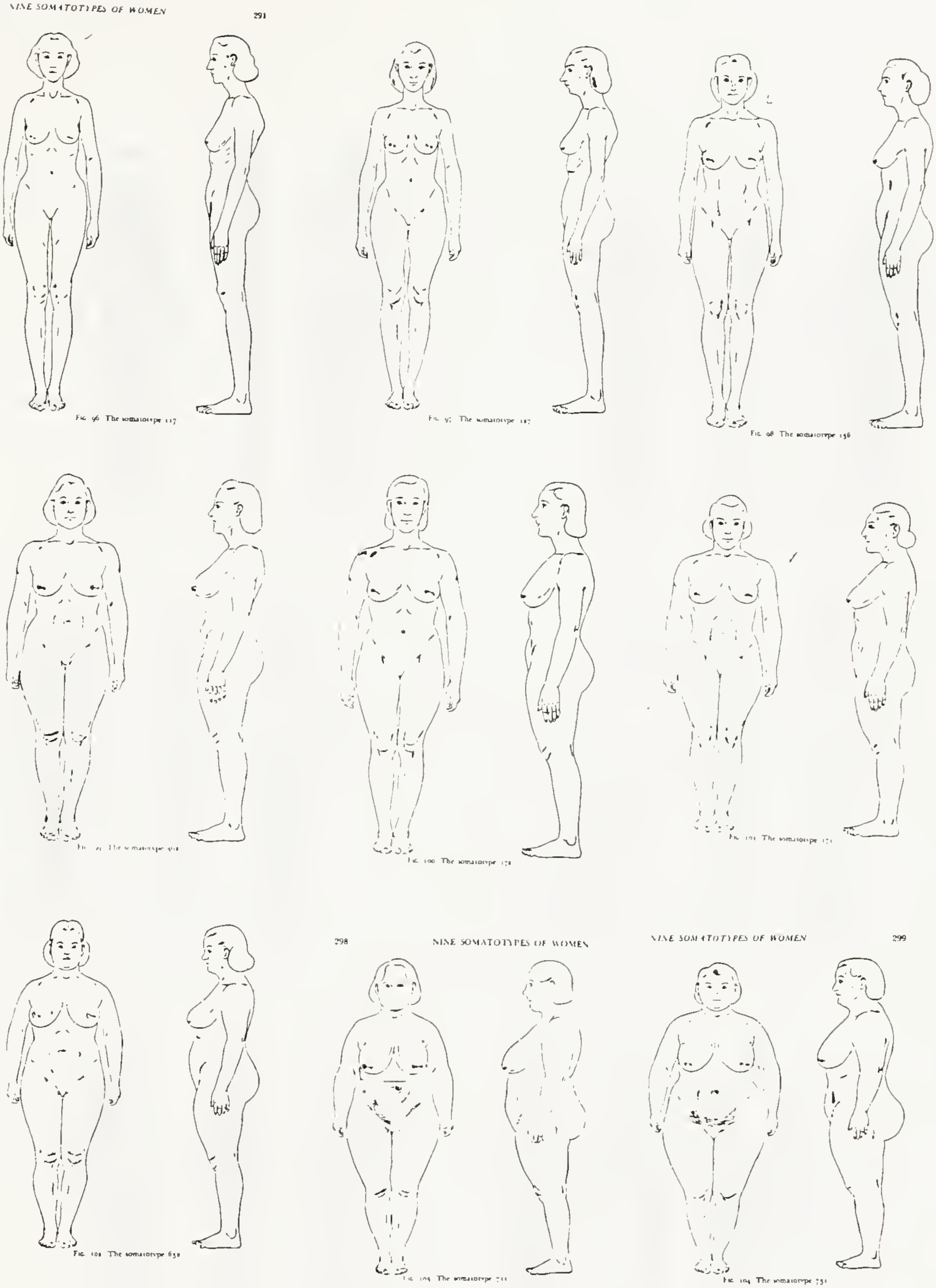
> ...The 262 is ideally equipped for [illegible] weight [illegible] feet [illegible] gets too much to eat, he [illegible] but it will be a general [illegible] blowout...[illegible]

> The skin is [illegible] pink color [illegible] but not fat, [illegible] "buddha"...[illegible]

FIG. 8. A machine for determining the somatotype from anthropometric measurements. Procedure: The anthropometric measurements are made on a photograph. A slider is set to the measured value of each of the 18 anthropometric indices (horizontal scales). By turning a switch (one switch for each somatotype) the operator turns on a light (seen as a bright spot on each slider) corresponding to some one value of each anthropometric index. The operator's problem is simply to determine which switch will turn on lights nearest the centers of the sliders. The somatotype corresponding to that switch is the somatotype of the individual.

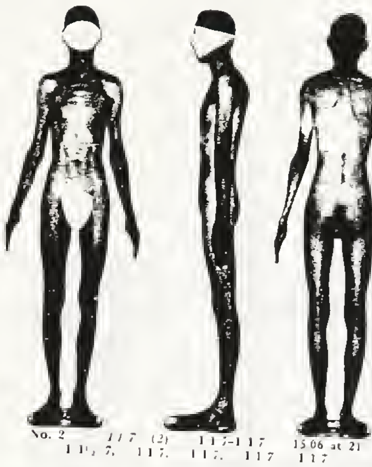
Sheldon's "machine" for determining somatotypes from anthropometric measurements from his photographs. From *Varieties of Human Physique*, p. 105.

Sheldon trained graduate students in psychology to somatotype individuals, and using the 4000 original photographs, achieved a "remarkably high" agreement of serial sortings. Sheldon had yet to apply his schema to women. He did attempt



Nine hypothetical somatotypes of women. Drawings compiled from "shadow pictures" taken for the purpose of posture study. From *Varieties of Human Physique*, pp. 291-99.

117



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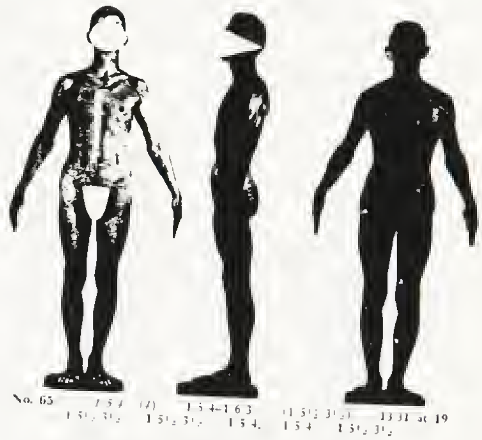

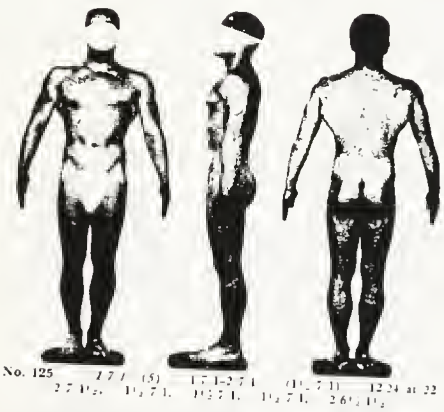

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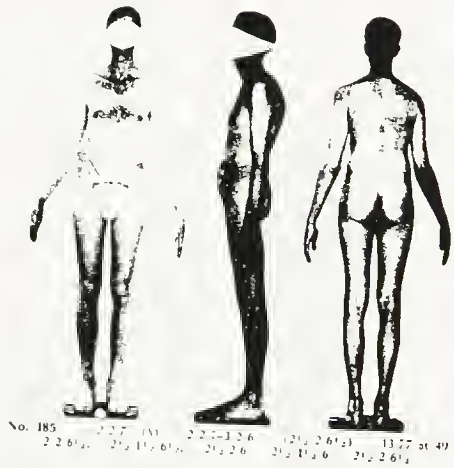

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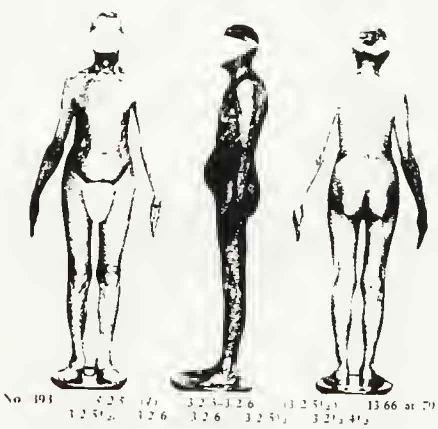

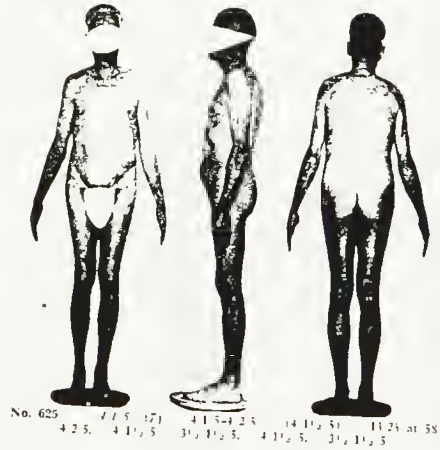

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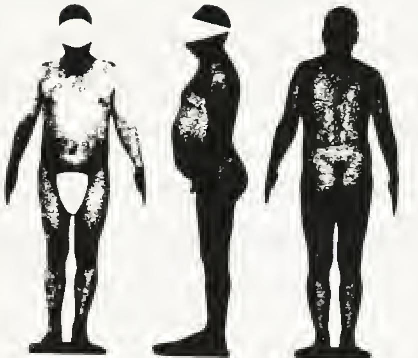
Twelve representative somatotypes from W.H. Sheldon's *Atlas of Men* (1954)

442



No. 721 4 4 2 (10) 4 4 2–4 5 1 (4 4½ 1½) 11.67 at 55
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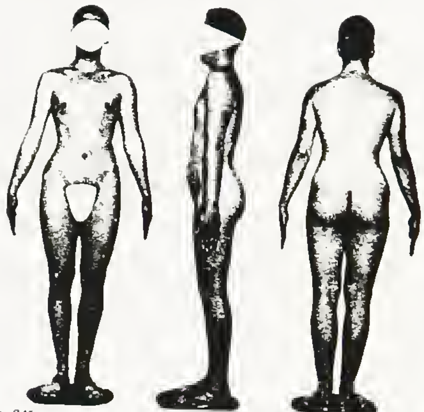
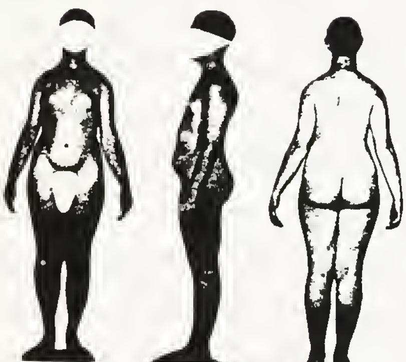
533

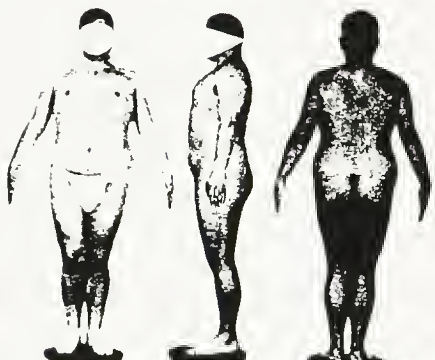


No. 945 5 3 3 (7) 5 3 3–5 3 4 (5 3 3½) 12.92 at 19
4½ 3 3½ 5 3 4 5 3 3½ 5 3 4, 5 3 3½



612

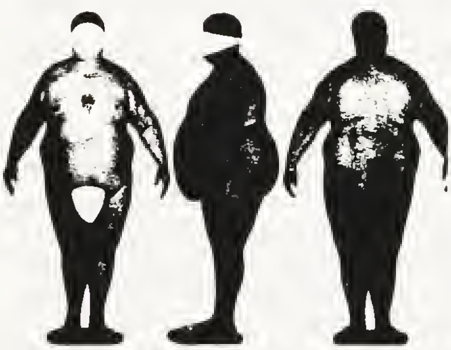
No. 1042 6 1 2 (1) 6 1 2–6 1 2 12.46 at 18
6 1½ 2, 6 1 2, 6 1 2½, 6 1 2, 6 2 1½



631

No. 1104 6 3 1 (15) 6 3 1–7 3 2 (6½ 3 1½) 11.27 at 24
6½ 3 1½ 7 3 1½, 6½ 3 1½, 6½ 3 1½, 7 2½ 1

721



No. 1155 7 2 1 (2) 7 2 1–7 2 1 9.10 at 39
7 2 1, 7 2 1, 7 2 1, 7 2 1, 7 2 1

731

No. 1166 7 3 1 (2) 7 3 1–7 3 1 10.20 at 26
6½ 2½ 1, 7 3 1, 7 3 1, 7 3 1, 7 3 1

to utilize "shadow pictures" taken onto bromide paper for the "purposes of postural study", but found them relative worthless to him for his anthropometric work. He compiled only artist's renditions of representative hypothetical somatotypes of women. However, his enthusiasm for the new technique was evident: "Clearly, by following simple empirical procedures we had devised a method of physical classification which appeared basically sound and highly practical. We had permanent records of most, if not all, of the recurrent patternings of physique in a large population, and we know the approximate relative frequency of all these combinations."[134] With his objective morphological scale complete, W.H. Sheldon set out to further delineate the pathway of *Constitutional Psychology.*

Dr. Sheldon and his colleagues sought a basic taxonomy of human beings--"a frame of reference which can account for most of the variety of human differences."[135] *Varieties of Human Physique* established for Sheldon what he felt was an objective system for classifying morphology. Two years later, his second book: *The Varieties of Human Temperament*, stood as his maiden attempt to use the instrument (of somatotyping) to correlate the static habitus of a person with the more dynamic aspects of his temperament. Lulled by the notion that in nature structure must somehow determine function, Sheldon remained optimistic that morphological variables could someday portend psychological ones. He wrote: "Of course it is possible that there is no such relation. But it is also possible that the relation is definite, although concealed in complexity, and that it is only to be disclosed when we shall have learned to choose the proper variables for our studies."[136]

Sheldon wrote that his initial intention was to co-publish the two books under the title Physique and Temperament:

> Taken together, the two volumes describe the principal tenets of what we have called a constitutional psychology--so named because the primary concern is to describe and interpret the most deep-seated pattern, presumably the constitutional pattern, of the individual personality...a third volume [Varieties of Delinquent Youth] will present the results of a recent application of constitutional psychology to the diagnosis, and to some extent to the vocational redirection, of one hundred delinquent or maladapted young men. It is hoped that another, less imminent volume will shed light on the problem of constitutional predisposition to disease (constitutional medicine).[137]

Indeed, Sheldon alluded to the second volume being underway at the time of the printing of *Varieties of Human Physique.* In a sense, he undermined any objective perspective he might have had when preparing his physical and temperamental studies. In both volumes, Sheldon hints at the fact that the classification of temperament types began before the morphological system developed. However, as stated above, Sheldon contended that the three-tier morphological schema objectively and obviously surfaced from the grouping of 4000 photographs, and likewise strongly contends that the three-tiered temperamental scale also resulted objectively from clustering on his psychological tests. The distinction over which system is likely to have been developed first is a mute point: in any case, the classifications were intimately linked, and clearly the subjects' assignments to morphological and temperamental clusters were ripe with subjective bias. Sheldon wrote in the first book, "These components of temperament appear to correlate with patterns of somatotypes, and like the morphological components, they combine in various proportions in different individuals. They behave, within limits, as independent variables.[138] The temperamental characteristics are briefly described thus:

Viscertonia in its "extreme manifestation is characterized by general relaxation, love of comfort, sociability, conviviality, gluttony for food, for people, and for affection...people who 'suck hard at the breast of mother earth' and love physical proximity with others...The personality seems to center around the viscera. The digestive tract is king, and its welfare appears to define the primary purpose of life."

Somatotonia is defined when "...the motivational organization seems dominated by the soma. These people have vigor and push. The executive department of their internal economy is strongly vested in their somatic muscular systems. Action and power define life's primary purpose"

Cerebrotonia is "roughly a predominance of the element of restraint, inhibition, and of the desire for concealment. Cerebrotonic people shrink away from sociality as from too strong a light. They 'repress' somatic and visceral expression, are hyperattentional, and sedulously avoid attracting attention to themselves. Their behavior seems dominated by the inhibitory and attentional functions of the cerebrum, and their motivational hierarchy appears to define an antithesis to both of the other extremes.[139]

Indeed, Sheldon alluded to the second volume being underway at the time of the printing of *Varieties of Human Physique*. In a sense, he undermined any objective perspective he might have had when preparing his physical and temperamental studies. In both volumes, Sheldon hints at the fact that the classification of temperament types began before the morphological system developed. However, as stated above, Sheldon contended that the three-tier morphological schema objectively and obviously surfaced from the grouping of 4000 photographs, and likewise strongly contends that the three-tiered temperamental scale also resulted objectively from clustering on his psychological tests. The discussion over which system is likely to have been developed first is a mute point. In any case, the classifications were intimately linked, and clearly the subjects' assignments to morphological and temperamental clusters were rife with subjective bias. Sheldon wrote in the first book, "These components of temperament appear to correlate with patterns of somatotypes, and like the morphological components, they combine in various proportions in different individuals. They behave, within limits, as independent variables."[188] The temperamental characteristics are briefly described thus:

Viscerotonia in its "extreme manifestation is characterized by general relaxation, love of comfort, sociability, conviviality, gluttony for food, for people, and for affection...people who 'rest back' in the bosom of mother earth' and love physical proximity with others...The personality seems to center around the viscera. The digestive tract is king, and its welfare appears to define the primary purpose of life."

Somatotonia is defined where "...the motivational organization seems dominated by the soma. These people have vigor and push. The executive department of their internal economy is strongly vested in their somatic muscular systems. Action and power define life's primary purpose."[189]

Cerebrotonia is "roughly a predominance of the element of restraint, inhibition, and of the desire for concealment. Cerebrotonic people shrink away from sociality as from too strong a light. They 'repress' somatic and visceral expression, are hyperattentional, and sedentary work of occupying attention to themselves. Their behavior seems dominated by the inhibitory and attentional functions of the cerebrum, and their motivational hierarchy appears to define an antithesis to both of the other extremes."[190]

26 THE SCALE FOR TEMPERAMENT

Fig. 5
THE SCALE FOR TEMPERAMENT

Name *Date* *Photo No.* *Scored by*

I Viscerotonia. . . .	II Somatotonia. . . .	III Cerebrotonia. . . .
( ) 1. Relaxation in Posture and Movement	( ) 1. Assertiveness of Posture and Movement	( ) 1. Restraint in Posture and Movement, Tightness
( ) 2. Love of Physical Comfort	( ) 2. Love of Physical Adventure	— 2. Physiological Overresponse
( ) 3. Slow Reaction	( ) 3. The Energetic Characteristic	( ) 3. Overly Fast Reactions
— 4. Love of Eating	( ) 4. Need and Enjoyment of Exercise	( ) 4. Love of Privacy
— 5. Socialization of Eating	— 5. Love of Dominating, Lust for Power	( ) 5. Mental Overintensity, Hyperattentionality, Apprehensiveness
— 6. Pleasure in Digestion	( ) 6. Love of Risk and Chance	( ) 6. Secretiveness of Feeling, Emotional Restraint
( ) 7. Love of Polite Ceremony	( ) 7. Bold Directness of Manner	( ) 7. Self-Conscious Motility of the Eyes and Face
( ) 8. Sociophilia	( ) 8. Physical Courage for Combat	( ) 8. Sociophobia
— 9. Indiscriminate Amiability	( ) 9. Competitive Aggressiveness	( ) 9 Inhibited Social Address
— 10. Greed for Affection and Approval	— 10. Psychological Callousness	— 10. Resistance to Habit, and Poor Routinizing
— 11. Orientation to People	— 11. Claustrophobia	— 11. Agoraphobia
( ) 12. Evenness of Emotional Flow	— 12. Ruthlessness, Freedom from Squeamishness	— 12. Unpredictability of Attitude
( ) 13. Tolerance	( ) 13. The Unrestrained Voice	( ) 13. Vocal Restraint, and General Restraint of Noise
( ) 14. Complacency	— 14. Spartan Indifference to Pain	— 14. Hypersensitivity to Pain
— 15. Deep Sleep	— 15. General Noisiness	— 15. Poor Sleep Habits, Chronic Fatigue
( ) 16. The Untempered Characteristic	( ) 16. Overmaturity of Appearance	( ) 16. Youthful Intentness of Manner and Appearance
( ) 17. Smooth, Easy Communication of Feeling, Extraversion of Viscerotonia	— 17. Horizontal Mental Cleavage, Extraversion of Somatotonia	— 17. Vertical Mental Cleavage, Introversion
— 18. Relaxation and Sociophilia under Alcohol	— 18. Assertiveness and Aggression under Alcohol	— 18. Resistance to Alcohol, and to Other Depressant Drugs
— 19. Need of People When Troubled	— 19. Need of Action When Troubled	— 19 Need of Solitude When Troubled
— 20. Orientation Toward Childhood and Family Relationships	— 20. Orientation Toward Goals and Activities of Youth	— 20. Orientation Toward the Later Periods of Life

Note: The thirty traits with parentheses constitute collectively the short form of the scale.

W.H. Sheldon's scale for temperament. From *Varieties of Human Temperament* (1942)

Sheldon's personality scale emerged from a compiled list of 650 traits. The research group weighed, condensed, and systematically described the traits, settling on a nucleus of 50 concepts representative of the traits. Then 33 male graduate students, young instructors, and academics underwent a series of 20 analytic interviews and were observed in their routines for one academic year. Based on

the notes taken by examiners and test results, a 50 x 50 correlation table was assembled, and traits which tended to cluster together were noted. Not surprisingly, "...[the researchers] soon found that three groups of traits showed positive intercorrelation among themselves, *and negative correlation with all or nearly all of the other traits.*"[140] Sheldon arbitrarily set a criteria that a positive correlation coefficient of at least +0.60 must be present for a trait to incorporate into one of the three nuclear groups, and simultaneously exhibit a correlation coefficient of at least -0.30 with all traits belonging to the other two nuclear groups. Thus, a list of 22 traits fulfilling the above criteria remained, and these eventually founded the viscerotonic, somatotonic, and cerebrotonic classifications. Utilizing this "short list", Sheldon and his colleagues were eventually able to expand the nuclear group trait lists to 20 each (60 traits in all).

400 STATISTICAL RELATIONS AMONG VARIABLES

TABLE 14

INTERCORRELATIONS AND INTRACORRELATIONS AMONG THE PRIMARY COMPONENTS

N = 200

	Viscero-tonia	Meso-morphy	Somato-tonia	Ecto-morphy	Cerebro-tonia
Endomorphy	+ 79	− 29	− 29	−.41	− 32
Viscerotonia		−.23	− 34	− 40	− 37
Mesomorphy			+.82	−.63	−.58
Somatotonia				−.53	−.62
Ectomorphy					+ 83

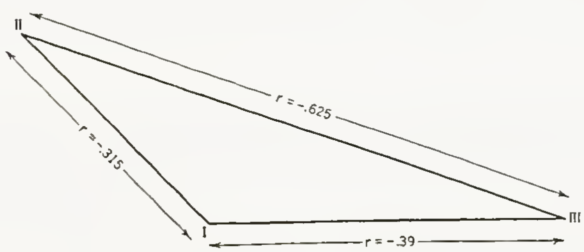


FIG. 7. A Triangle Representing the Apparent Relationships among the Primary Components.

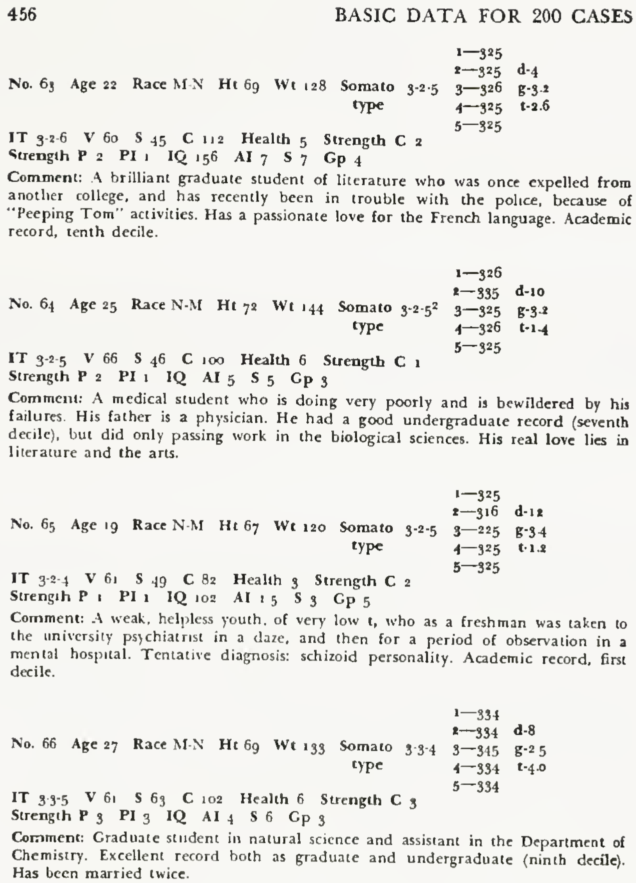
(Above) Sheldon's correlations between morphology and temperament. (Below) Graphic relationship between the three extremes of temperament. From *Varieties of Human Temperament*, p. 400.

Sheldon and his colleagues, notably Dr. Stephens at Harvard, then undertook the extended study of 200 young men over five years. Each of the subjects underwent somatotype evaluation and rigorous personality testing using

the scales and diagnostic criteria that Sheldon devised. Subjects underwent no less than 20 analytic and medical interviews, and were observed by examiners "in as many different situations as possible." Then, as for the somatotypes, each subject received a three number score indicating the relative contributions of viscerotonia, somatotonia, and cerebrotonia in their temperaments. The results are reported as short case studies in *Varieties of Human Temperament*: "Correlations of the order of about +0.80 between the two levels of personality (morphological and temperamental) indicate that temperament may be much more closely related to the physical constitution than has usually been supposed."[141]

Sheldon took care to point out, however, that the correlations were by no means perfect. He notes several cases of "incompatibility" between morphology and manifest temperament, and proceeds to hypothesize that such discrepancy of structure and function often is found in individuals with "severe internal conflict."[142] Perfect agreement between somatotype and temperament occurred in 14 of the 200 cases--always in "common" somatotypes, and in no case where the endomorphic component was dominant. "Taken as a whole, this is a normal, excellently adapted group of people." Sheldon never clearly defines his criteria for considering his subjects well adjusted; much of the book is devoted to cataloging and stereotypically characterizing the individual observed temperamental types. In addition, he encountered temperamental indices which fell outside the range of somatotypes he observed (i.e. 137, 272, 315, etc.) Excerpts from descriptions among the cases shed light on the imprecise deductive methods employed by the research group:

> ...The first of these, case 21, jumps from 5 in ectomorphy to the extreme 7 in cerebrotonia and presents a personality so cerebrotonic that the prognosis must be considered poor.[143]
>
> ...Case 23, also a 2-3-5 in somatotype, jumps from 3 in mesomorphy to 5 in somatotonia to establish a somatotonic predominance which reverses the morphological predominance between the second and third components. This youth has fallen into bitter somatoerotic hostility toward his environment and even toward his species as a whole. But he has thrown unusual mental and volitional resources into the struggle and he appears to stand a good chance to survive.[144]


456 BASIC DATA FOR 200 CASES

1—325
2—325 d-4
No. 63 Age 22 Race M-N Ht 69 Wt 128 Somato type 3-2-5 3—326 g-3.2
4—325 t-2.6
5—325
IT 3-2-6 V 60 S 45 C 112 Health 5 Strength C 2
Strength P 2 PI 1 IQ 156 AI 7 S 7 Gp 4

Comment: A brilliant graduate student of literature who was once expelled from another college, and has recently been in trouble with the police, because of "Peeping Tom" activities. Has a passionate love for the French language. Academic record, tenth decile.

1—326
2—335 d-10
No. 64 Age 25 Race N-M Ht 72 Wt 144 Somato type $3\text{-}2\text{-}5^2$ 3—325 g-3.2
4—326 t-1.4
5—325
IT 3-2-5 V 66 S 46 C 100 Health 6 Strength C 1
Strength P 2 PI 1 IQ AI 5 S 5 Gp 3

Comment: A medical student who is doing very poorly and is bewildered by his failures. His father is a physician. He had a good undergraduate record (seventh decile), but did only passing work in the biological sciences. His real love lies in literature and the arts.

1—325
2—316 d-12
No. 65 Age 19 Race N-M Ht 67 Wt 120 Somato type 3-2-5 3—225 g-3.4
4—325 t-1.2
5—325
IT 3-2-4 V 61 S 49 C 82 Health 3 Strength C 2
Strength P 1 PI 1 IQ 102 AI 1.5 S 3 Gp 5

Comment: A weak, helpless youth, of very low t, who as a freshman was taken to the university psychiatrist in a daze, and then for a period of observation in a mental hospital. Tentative diagnosis: schizoid personality. Academic record, first decile.

1—334
2—334 d-8
No. 66 Age 27 Race M-N Ht 69 Wt 133 Somato type 3-3-4 3—345 g-2.5
4—334 t-4.0
5—334
IT 3-3-5 V 61 S 63 C 102 Health 6 Strength C 3
Strength P 3 PI 3 IQ AI 4 S 6 Gp 3

Comment: Graduate student in natural science and assistant in the Department of Chemistry. Excellent record both as graduate and undergraduate (ninth decile). Has been married twice.

Page 456 from *Varieties of Human Temperament.* The basic data from his 200 cases was compiled in a summary.

Sheldon commented on the difficulty of interpreting his results. He ascribed much of the problem to "halo error." Observer bias, Sheldon felt, could not have been eliminated, because an observer can not make temperamental ratings without seeing the subject, and any investigator trained in the "constitutional method" would immediately somatotype a subject: "To ask a constitutional psychologist to look at a jiggly 6-2-2, or a stalwart 2-6-2 without 'realizing' what they are is like asking an ornithologist to observe geese and crows without being aware which is which."[145] Even in his admission of guilt, Sheldon obviously does not entertain the possibility that his morphologies do not portend characteristic temperamental behaviors. That is precisely the thesis he set out to prove, and yet he accepts it as

fact when justifying his bias. Indeed, Sheldon actually felt the error would be "self-correcting" in the long run, because "the more experienced psychologist is more likely...to note any true deviations from the 'expected pattern'."[146]

In addition, Sheldon divulges the results he obtained when he evaluated his instrument. Remarkable differences surfaced between the correlations between the "best and poorest" raters (congruency to Sheldon's ratings as the measure of "best"). He dismisses the imprecision of his instrument with a ludicrous analogy:

> Dr. Harvey Cushing used to say that doubtless a certain proportion of young surgeons possess the native aptitude to become good brain surgeons. He always added that in order to do so it is necessary to give over everything else and to *live* brain surgery under close supervision for a long term of years. That may be about how matters stand in the field of temperamental study.[147]

As further insult to his ailing schema, Sheldon introduced flagrantly subjective shortened versions of the instrument, which included the subjects' reactions to 20 minutes worth of tasks, ranging from monitoring his/her reactions to being in a "very low, heavily upholstered (viscerotonic) chair, from which he must several times rise in order to meet the requests of the experimenter", to weight lifting, and hand dynamometry. The subject might have been offered an ounce of whiskey, and at the end of the interview be offered "his choice between a Hershey bar and a cigar."

Clearly the constitutional method had yet to prove itself by any *bona fide* scientific criteria, but Sheldon (even during the testing of his hypothesis) accepted his tenets as fact. The most striking proof of this lay in his third major contribution in the field *The Varieties of Delinquent Youth.* The groundwork for this book signified the first clinical application of the constitutional method. The Hayden Goodwill Inn, an institution to which problem adolescents were sent for rehabilitation in Dorchester, Massachusetts became the first testing ground for W.H. Sheldon's schema:

> ...in the late 1930's, as many as 648 boys passed through the Inn in one year...It was for [the more permanent residents] that we needed a method of evaluation that took little time and made good clinical sense. We had to determine (a) whether we could work constructively with the boy in our group setting, (b) what strengths, weaknesses, and potentials for growth he showed, and (c) whether the resources available either in the house or in the community could meet his needs...It was that pressing need that led to the

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As further insult to his sitting subjects, Sheldon introduced flagrantly subjective shortened versions of the instrument, which included the subjects' reactions to 20 minutes worth of tasks, ranging from monitoring bodily reactions to being in a "very low, heavily upholstered (overstuffed) chair, from which he must several times rise in order to meet the requests of the experimenter", to weight lifting, and hand dynamometry. The subject might have been offered an ounce of whiskey, and at the end of the interview he offered "his choice between a Hershey bar and a cigar."

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development of the Youth Guidance Clinic, with William H. Sheldon as its first clinical director.[148]

At the Inn, assessments of somatotypes became a part of the usual diagnostic work-up for the adolescents. The somatotypes, used in conjunction with Sheldon's temperament preconceptions, became a keystone in the development of personal treatment and vocational redirection plans for the youths. An ironic and arguably unethical situation had been allowed to exist--Sheldon published his observations on 200 of the tenants at the Inn all the while he employed his unproven psychological theories to guide their rehabilitation.

In 1982, three of Sheldon's colleagues who worked with him at the Hayden Goodwill Inn: Emil Hartl Ph.D.; Edward Monnelly, M.D.; and Roland Elderkin, M.S.W. published *Physique and Delinquent Behavior: A Thirty Year Follow-Up of William H. Sheldon's Varieties of Delinquent Youth.* Sheldon passed away in 1977, but the researchers continued to follow the 200 youths whos case studies Sheldon published in the third volume of his "constitutional series". Again, the book is essentially an anachronistic collection of case studies, plethoric with anecdotal conjecture and misled hypothesis, couched in trite psychoanalytic jargon. The weakness of the results is reported by the researchers:

> Of all the findings from the original publication of Varieties of Delinquent Youth, the one that has stood up most consistently is the association of mesomorphic body build with juvenile delinquency...Thus our data support the view that mesomorphy is the dominant component in any series of college men, or in any other series of men for that matter...But it is more than mesomorphy that makes up the constitutional pattern found in civil delinquency: Low ectomorphy and high andromorhpy are the other constitutional elements that we find to be strongly associated with criminality...[149]

Any perfunctory examination of Sheldon's theories, instrument, or conclusions exposes the work for its subjective, biased, and un-scientific nature. Sheldon, like Agassiz and Morton, developed *a priori* convictions about his theories (temperament and morphology) which he could not divorce. Agassiz and Morton lacked a certain sophistication and understanding of statistical methods which should have been apparent to Sheldon by the 1940's. The preconceptions are obvious in his earliest work, and ironically, one can easily read Sheldon's tack from his seemingly objective, pseudo-scientific case studies. Similar to the criticisms of

development of the Yough Guidance Clinic, with William H. Sheldon as first clinical director.[156]

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> Of all the findings from the original publication of Varieties of Delinquent Youth, the one that has attracted the most attention is [illegible] mesomorphic body build with [illegible] [157]

Any perfunctory examination of Sheldon's theories [illegible] assessments of [illegible] [illegible] Sheldon, like Aquinas and Maritain, developed a [illegible] temperament and morphology which he could not [illegible] lacked a certain [illegible] should have been apparent to Sheldon by the 1940s. The [illegible] obvious to his earliest work, and [illegible] his seemingly objective, pseudo-scientific [illegible]

Harvey Cushing's laboratory science, Sheldon embraced too intimately his theories. However, unlike Cushing (who's experiments were objective, and he simply refused to acknowledge the facts), Sheldon's correlations never aspired to objectivity. Where Dr. Cushing published *The Pituitary Body and its Disorders* in 1912, little more than a collection of case studies based in simple observation; Sheldon published his anachronistic *Varieties of Human Temperament* in 1942--a collection of case studies based on data uncomfortably stereotyped to conform to Sheldon's prejudices. Inexcusably, it was published in a time where more sophisticated scientific methods were the norm. He followed with the publication of *Varieties of Delinquent Youth* in 1949, equally anachronistic and somewhat morally disturbing. No doubt, Sheldon's unproven, conjectural methods were utilized for the rehabilitation of institutionalized youths. As of the publication of Physique and Delinquent Behavior in 1981, his "constitutional method" had been applied to over 1900 youths. The schema was used until very recently at the Hayden Goodwill Inn, where Dr. Hartl, loyal follower of W.H. Sheldon, still holds tenure.

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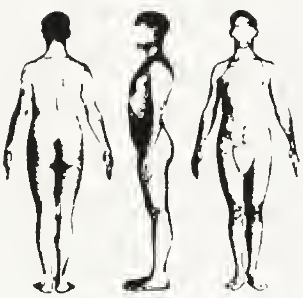
NO. 108 GYNEPHRENOSIS; BORDERLINE PSYCHOPATHY



Description--Somatotype 4½-4-3½. Ht 70.5, Wt 170, col. → 30. Died at age 35. A mesomorphic endomorph. Soft, heavily built man, massive and solid through the trunk and neck. A 4, G 5. SI^1 4, SI^2 3½. Features strongly formed but a little asymmetrical. Hands fragile and weak. GStr 3, HStr 2, En 3½. Coordination poor. Physically ineffectual in spite of abundant energy.

Temperament--At the Inn, his outstanding characteristic was too much energy. Mesotonia and endotonia were both present in overwhelming strength; they appeared to get continuously tangled. He was enthusiastic, impulsive, unrestrained; was inclined toward alcoholism and became even more Dionysian with that drug. Sociophilic to an extreme degree. Endotonia weakly manifested. He was an extreme extravert, both endotonic and mesotonic. The youthful psychiatric pattern was hypomanic although that does not necessarily imply a psychotic element. His later affective expression was depressive admixed with elements of paranoid hostility and suspicion. His alcoholism increased together with a frustrated homosexuality. , 5-2-1. H 2-1½-1.

Delinquency--Referred to the Inn on psychiatric grounds. No adolescent delinquency. Only adult record for periodic bouts of drinking.

280 3 Biographies of the 200 Men

Family--Third of four. Both parents of old New England stock. Father of heavy build and emotionally unstable. Became alcoholic and manic, often hospitalized; finally deserted the family. He died in a mental hospital at age 70. Mother of heavy, andric build and called hysterical and unreliable. She was supported largely by social agenies. Died of pneumonia in her 70s. Boy raised by his mother. Sisters considered "odd" in behavior. This man never married, had no children and no established home.

Mental history--Considered peculiar in high school but enjoyed his schooling. IQ high average but poorly disciplined. Finished a year of college with passing grades though with psychiatric difficulties. Many divergent vocational plans. Wanted to be a great religious reformer or a successful business man. Said he had the "call to preach." No further formal adult education.

Medical--Serious and nervous as a child. Broke down three times in college and hospitalized for observation. Many somatic complaints. Long list of psychiatric referrals with various diagnoses: simple behavior disorder; psychopathic personality; dementia praecox, hebephrenic; prepsychotic, manic-depressive, mixed.

The sexual problem became of increasing concern as the years passed. He was not a successful homosexual and had no heterosexual experience of any importance. With increasing sexual frustration, he resorted more and more to drinking. He developed a gross hand tremor, failed in business, alienated his friends, became increasingly morose and despondent, and finally committed suicide at age 35. Alc 4, Tob 2.

Social history--At the Inn he behaved like a gentlemanly and Promethean DAMP RAT. He was effeminate, dilettante, arty, and affected in his speech and mannerisms. But he was a good worker and wanted to save the world, although he himself was constantly embroiled in struggle with religion, economics, and sexuality, and caught between hetero- and homosexual leanings. He was overenergized and could find no channels for the adequate expression of his energies.

After leaving the Inn he entered military service, but was soon discharged for medical reasons without pension. Started many jobs but failed to stay long with any of them. The struggle with his various conflicts continued, but the adult story became more sordid. The Promethean flush and the missionary urge were completely put to rout by his furious efforts to do well at work and to satisfy his sexual cravings. He became increasingly alcoholic. As his economic security decreased, his despondency increased. He ended his life by shooting himself on the bed of the male partner in an unrequited love affair.

Summary--An overenergized gynic man who was physically ineffectual. Mentality at college level. DAMP RAT syndrome. Psychiatric difficulties, Dionysian alcoholism, and sexual problems.

Typical case study from Varieties of Delinquent Behavior (1982).

Sheldon and Hartl began work on an atlas, a sort of periodic table of human variation intended to serve as an objective guidebook to be used for morphology and its correlation. Photographs were taken with the cooperation of the departments of physical education at 31 colleges and universities, usually under the guise of a "posture photograph" taken for "body mechanics" courses. Sheldon had photographed over 46,000 men by his report, and upon the publication of his *Atlas*

Typical case study from *Varieties of Delinquent Behavior* (1949)

Sheldon and Hartl [illegible] work on [illegible] scores of [illegible] variation intended to serve as an objective guide [illegible] its correlation. Photographs were taken with the cooperation [illegible] of physical education at 21 colleges and universities, [illegible] "posture photographs" taken for "body mechanics" [illegible] photographed over 46,000 men by his [illegible]

of Men in 1954, he intended to follow with an *Atlas of Women* as well.[150] He wrote of the photographic collection he had amassed:

> Suffice it to say that among the portraits to be encountered on the plates of the atlas are those of men of distinction. Eminent professors are there, philosophers and doctors, a sprinkling of really topflight athletes, a constitutional psychologist, two or three murderers, and one of the most accomplished check forgers in the country...[151]

In addition, Sheldon set up the Constitutional Laboratory at the College of Physicians and Surgeons of Columbia University in 1947, and a second branch of this laboratory at the University of Oregon Medical School four years later. The purpose of the labs included the study of "diabetes, peptic ulcer, gallbladder disease, heart disease, and hypertensive vascular disease, rheumatoid arthritis, thyroid disorders, cancer of several kinds, and the cycloid and schizophrenic psychoses." Sheldon felt these diseases to be more or less constitutional, and would be portended through morphology. His constitutional psychology became a popular movement in academic and social circles, even lay publications across the country.

Aside from the work of Hartl and a few of his colleagues, W.H. Sheldon and his work largely fell out of favor beginning in the early 1950's. Ironically, his demise did not come so much at the hands of the academic world, but rather the public. The *commencement de la fin* came in September of 1950, at the University of Washington in Seattle. A young woman, so distraught at having her body photographed in the nude, told her parents of the ordeal. Lawyers and University officials appeared in Sheldon's laboratory there the next day and burned all photos of women. Similar actions were taken at Harvard, Vassar, and Yale through the 1960's and 1970's, and colleges all over the country slowly divested from Sheldon's project. He could never complete his *Atlas of Women*. He continued his work at Columbia and the Hayden Inn, but clearly the popular tide had turned on Sheldon and the constitutional method. By the time of his death in 1977, his theories, photographs, and schema had been largely dismissed.

Many of William H. Sheldon's posture photographs, lost, abandoned, forgotten, or stored, resurfaced from time to time across the country. Occasional allusions to the practice of posture photography appeared from time to time, notably

in author Naomi Wolf's (Yale '84) 1992 *New York Times* Op-Ed piece attacking Dick Cavet (Yale '55) for lewd remarks made during her graduation ceremonies. The piece was followed by a letter to the *Times* by Yale history professor George Hersey: "A Secret Lies Hidden in Vassar and Yale Nude 'Posture Photos'" Hersey outlined the anthropological research carried out by E.A. Hooton and W.H. Sheldon at Harvard, and alluded similar photographic archives compiled in Nazi Germany. Indeed, Hersey's article bore on hyperbole: "...entire generations of America's ruling class had been unwitting guinea pigs in a vast eugenic experiment run by scientists with a master-race hidden agenda..."[152]

Then, on January 15, 1995, a New York Times Magazine article by Ron Rosenbaum entitled "The Great Ivy League Nude Posture Photo Scandal" sealed the fate of a number of the surviving photographs. Rosenbaum's article chronicled the late 1970's find of an enormous stash of posture photographs found in Yale's Payne-Whitney Gymnasium. Frank Ryan, athletic director of the school had the particular photographs burned, but Rosenbaum traced the story of the photographs, Sheldon's questionable research, and Hersey's views: "From the outset, the purpose of these 'posture photographs' was eugenic. The data accumulated, says Hooton, will eventually lead on to proposals to 'control and limit the production of inferior and useless organisms.' Some of the latter would be penalized for reproducing...or would be sterilized. But the real solution is to be enforced better breeding--getting those Exeter and Harvard men together with their corresponding Wellesley, Vassar and Radcliffe girls."[153]

Many 'posture photographs' had been taken even before the time of Sheldon. Harley P. Holden, curator of Harvard's archives said that Harvard conducted its own posture photograph program from the 1880's to the 1940's. However, most of the 3,500 photos were eventually destroyed for "privacy scruples". Rosenbaum followed the thread of Sheldon's research to Roland Elderkin, the 84 year old one-time colleague of Sheldon's. Elderkin, who hailed Sheldon as "the first to introduce holistic perspective" to American science, deposited the surviving posture photographs and papers in the National Anthropological Archives at the Smithsonian Institution. With some difficulty, Ron Rosenbaum convinced the curators of the Smithsonian to give him access to the photos. Descriptions of what he found accompanied his rather sensationalist piece.

Six days after the New York Times Magazine article appeared, Yale University and Mount Holyoke College bent to the pressure of some alumni, "some distraught, others mildly amused". The colleges asked the Smithsonian to cut off

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access (even to researchers) to the photographic archives. The Smithsonian vaulted the photographs with the intent that they remain sealed until the last of the subjects was deceased. Still, controversy lingered from the article. George L. Vogt, a member of Yale's class of '66 and director of the South Carolina Department of Archives and History wrote:

> ...written records of [Sheldon's] scientific pursuit, however odd, should be saved but that the photos should be burned...Our naked butts are in the Smithsonian...I can understand why the Smithsonian would want to record the quack science of the time, but I cannot understand, nor can I accept, that they would retain naked photographs of living people.[154]

Six days later, January 27, 1995, Yale officials visited the Smithsonian, and had 100 pounds of photographs of Yale students emptied into a shredder and then burned. Gary Fryer, a Yale spokesman said, "We are delighted that the privacy of the individuals in those photographs will be forever protected."[155] A few other institutions followed in Yale's shortsighted footsteps, and much of the archive was destroyed. Donald L. Ortner, director of the Smithsonian's Natural History Museum, shrewdly vaulted the remaining photographs indefinitely. Tragically, it appears that the only fruits of Sheldon's 40 years of misguided, conjectural research which might ever have held value expired under the weight of sensational controversy. Unlike Cushing's Brain Tumor Registry or Agassiz's daguerreotypes, William H. Sheldon's posture photograph archive has been denied to the future generation of scientists and historians and to their elusive paradigm.

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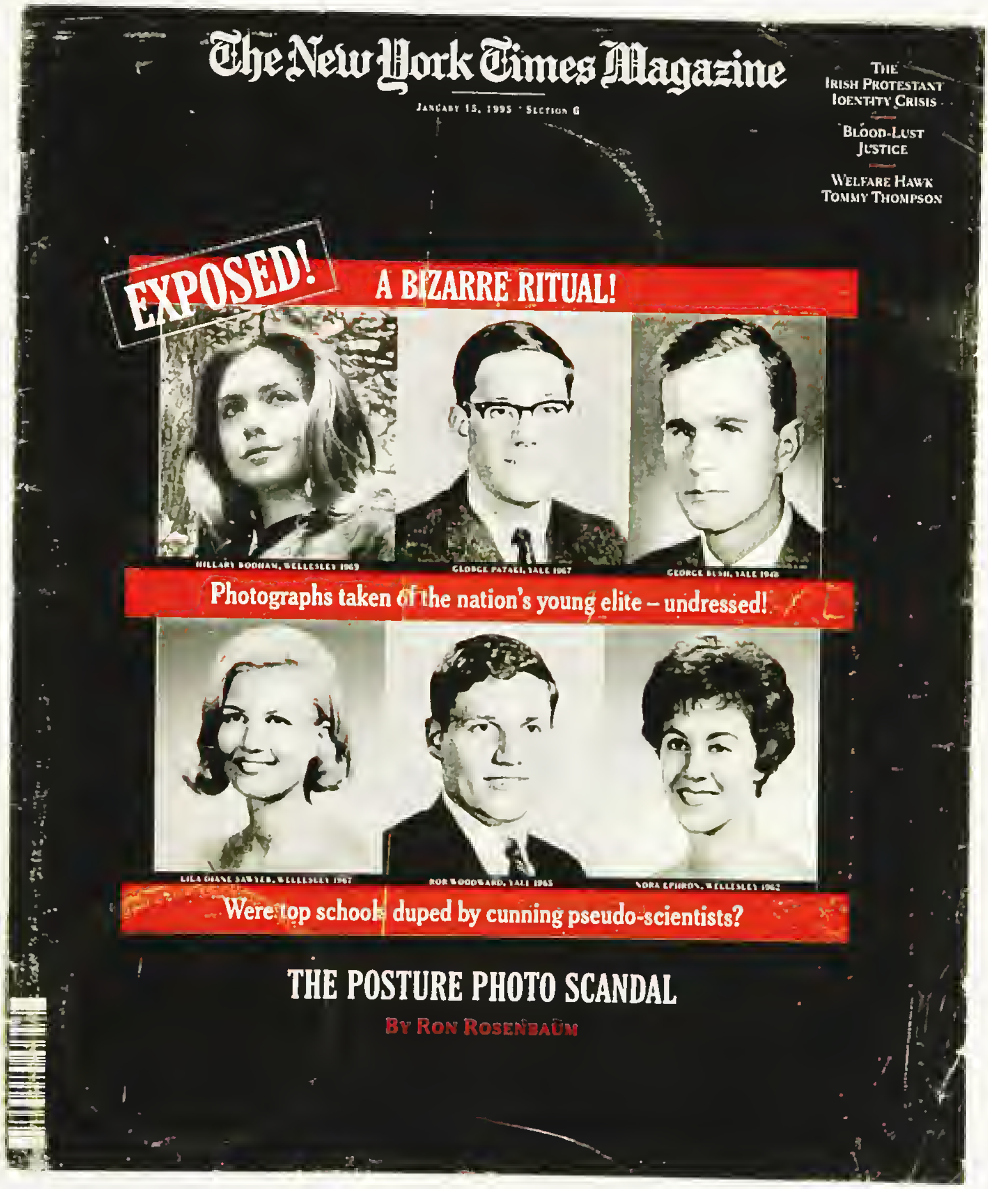

January 15, 1995 issue of *The New York Times Magazine*.

THE GREAT IVY LEAGUE NUDE POSTURE PHOTO SCANDAL

How scientists coaxed America's best and brightest out of their clothes.

ONE AFTERNOON IN THE LATE 1970's, deep in the labyrinthine interior of a massive Gothic tower in New Haven, an unsuspecting employee of Yale University opened a long-locked room in the Payne Whitney Gymnasium and stumbled upon something shocking and disturbing.

Shocking, because what he found was an enormous cache of nude photographs, thousands and thousands of photographs of young men in front, side and rear poses. Disturbing, because on closer inspection the photos looked like the record of a bizarre body-piercing ritual: sticking out from the

Above: W. H. Sheldon, the posture-photo guru. Left: Wellesley student (circa 1930) with posture-measuring pins. Examples of Sheldon's endo-, meso- and ectomorphs, right.

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NATIONAL SATURDAY, JANUARY 21, 1995

Nude Photos Are Sealed At Smithsonian

NEW HAVEN, Jan. 20 (AP) — The Smithsonian Institution has cut off all public access to a collection of nude photographs taken of generations of college students, some of whom went on to become leaders in American culture and government.

The pictures at first were taken to study posture. Later they were made by a researcher examining what he believed to be a relationship between body shape and intelligence.

All freshmen here at Yale and at some of the other colleges and universities involved were required to pose in the nude. Among those who were presumably subject to the practice are George Bush and Hillary Rodham Clinton, but it is not known whether their photos ever wound up at the Smithsonian, which, although having made its collection of the pictures available to researchers, has never displayed them.

"There are the rights of the subjects to consider," Ildiko P DeAngelis, assistant general counsel at the Smithsonian, said today in explaining its decision to seal the entire collection, even to researchers. The pictures will remain off limits, she said, until the Smithsonian completes an investigation of how it acquired them and whether it has rights to them.

The frontal and profile "posture" photos were taken beginning in the early 1900's as part of physical education classes, because poise and balance were considered an integral part of health.

Later, other photographs were taken by W H. Sheldon, a researcher who believed that there was a relationship between body shape and intelligence and other traits.

Mr. Sheldon has since died, and his work has long been dismissed by most scientists as quackery. But it was apparently respected from the 1940's through the 1960's, because highly regarded colleges like Yale, Wellesley, Harvard, Princeton, Vassar and Swarthmore allowed him access to their students.

Much of Mr. Sheldon's work was destroyed by various colleges years ago. But an article last Sunday in The New York Times Magazine disclosed that the Smithsonian still had some of the photos.

Yale officials had thought that they had long ago burned all the photos of their students. After receiving calls from alumni, some distraught and others mildly amused, Yale and Mount Holyoke College asked the Smithsonian this week to cut off access.

Ms. DeAngelis, assistant general counsel at the Smithsonian, said it was too early to determine whether the pictures would be destroyed One question is whether the photos have historical merit even though the science behind them is no longer considered valid. "Any kind of historical movement," she said, "the history of science itself, is educational"

George L. Vogt, a member of Yale's class of 1966 who is now director of the South Carolina Department of Archives and History, said that Mr. Sheldon's written records of his scientific pursuit, however odd, should be saved but that the photos should be burned.

"Our naked butts are in the Smithsonian," Mr Vogt said "I can understand why the Smithsonian would want to record the quack science of the time, but I cannot understand, nor can I accept, that they would retain naked photographs of living people."

Two *New York Times* articles chronicle the fate of many of Sheldon's remaining posture photographs.

Nude Photos of Yale Graduates Are Shredded

WASHINGTON, Jan. 28 (AP) — The Smithsonian Institution has destroyed nude photographs taken decades ago of Yale University students who were unaware the pictures were to be used in the pursuit of a form of science. The science has since been discredited.

After a request from the university, Smithsonian officials emptied more than 100 pounds of photos and negatives into a shredder on Friday at a museum office in Suitland, Md., a Washington suburb.

"All material in the National Anthropological Archives pertaining to Yale University students has been destroyed," said a museum spokesman, Randall Kremer.

The photos went to the shredder with a Yale representative looking on.

"We are delighted that the privacy of the individuals in those photographs will be forever protected," said a Yale spokesman, Gary Fryer.

Posing for the photos was required of students years ago at many Ivy League colleges and other prestigious schools, including Wellesley, Mount Holyoke, Vassar and Swarthmore.

Donald L. Ortner, director of the Smithsonian's Natural History Museum, said it would probably destroy all the photographs if the universities asked. Dr. Ortner said any historic or scientific value of the pictures "would be minimal."

The pictures were turned over to the institution after the death of the researcher who guided the project for years.

A statement from Yale said lawyers wanted the photos destroyed to protect the privacy of its graduates, many of whom have become leaders Among the people who would have been subject to the ritual were President Bush, Hillary Rodham Clinton and Diane Sawyer. It could not be confirmed whether their photos were in the collection.

Most of the photos were taken from the 1940's to the 1960's, under the guidance of a researcher, W. H. Sheldon, who was seeking to determine if there was a relationship between body shape and intelligence. Students, however, were generally told the pictures were used to study comparative postures.

Mr. Sheldon, whose work has since been dismissed by most scientists, died in 1977. Mr. Sheldon's research associate gave the photos to the Smithsonian.

The photos were never displayed at the Smithsonian and had been available only to students and researchers.

The Change in Paradigm as an Invitation to Truth and Sublimity

The essence, the content, the quantitative unity of a thing, can never be grasped by a 'step-by-step' process or measurement, but only by a comprehensive and immediate experience or 'vision'... A science based on qualitative analysis...must of necessity be blind to the infinitely fruitful and many-sided essence of things. For such a science, what the ancients called the "form" of a thing (i.e. its qualitative content) plays virtually no role. This is the reason why science and art, which in the prerationalistic age were more or less synonymous, are now completely divorced from one another, and also why beauty, for modern science, offers not the smallest avenue toward knowledge.

Burkhardt, *Alchemy*

In *The Structure of Scientific Revolutions*, Thomas Kuhn set out the landscape for a view of the history of science which simultaneously creates and destroys. The potent swell of scientific advance appears to conduct the depreciation of historical fact through radical changes in world view. These "paradigm shifts," brought into existence through growing disharmony within a scientific community, ironically rely on incongruencies in data. These inconsistencies gradually give way to novel modes of thinking which incorporate the new findings with the old data into a frame of reference which can accommodate both.

Looking back into history, the scholars of a new paradigm find it hard to appreciate the rich contexts--the social, political, religious, and scientific pretexts--that dictated the evolution of beliefs which preceded the change of paradigm. Much of the sophism is secondary to the fact that science can not evolve in a vacuum. Indeed, science is as intimately tied to its environs as is religion or politics. Gunnar Myrdal wrote:

> A handful of social and biological scientists over the last 50 years have gradually forced informed people to give up some of the more blatant of our biological errors. But there must be still other countless errors of the same sort that no living man can yet detect, because of the fog within which our type of Western culture envelops us. Cultural influences have set up the assumptions about the mind, the body, and the universe with which we begin; pose the questions we ask; influence the facts we seek; determine the interpretation we give these facts; and direct our reaction to these interpretations and conclusions.[156]

The Change in Paradigm as an Invitation to Trade and Solidarity

The essence, the content, the quantitative study of a thing, the sense of progress for a 'step-by-step' process or measurements, but only as a complementary and subordinate experience or 'fusion'... A science based on quantitative analysis—that of ecology—be blind to the infinitely fruitful and many-sided aspects of things. For such a science, what the ancients called the 'form' of a thing can, its qualitative content, plays virtually no role. This is the reason why science and art, which in the pre-renaissance age were more or less synonymous, are now completely divorced from one another, and why only remote [illegible] for modern science offers not the comfort and [illegible] knowledge.

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In *The Structure of Scientific Revolutions*, Thomas Kuhn set out the landscape for a view of the history of science which simultaneously creates and destroys. The potent swell of scientific advance appears to emulate the dispensation of historical fact through radical changes in world view. These "paradigm shifts," brought into existence through growing disharmony within a scientific community, gradually rely on reconfiguration in time. These reconfigurations gradually give way to novel modes of thinking which incorporate the new findings with the old data into a frame of reference which can accommodate both.

Looking back into history, the inheritors of a new paradigm find it hard to appreciate the rich concerns—the social, political, religious and economic pressures—that dictated the evolution of beliefs which preceded the change in paradigm. Much of the sophism is secondary to the fact that science can not exist in a vacuum. Indeed, science is so intimately tied to its environment as is religion or politics. Gunnar Myrdal writes:

> A mandate of social and biological scientists over the last 25 years have gradually forced informed people to give up many of the more obvious errors of biological errors. But there must be still countless errors of the same kind which no living man can yet detect, because of the fog within which our type of Western culture envelops us. Cultural influences have set up the assumptions about the mind, the body, and the universe with which we begin; pose the questions we ask; influence the facts we seek; determine the interpretation we give these facts; and direct our reaction to these interpretations and conclusions.[38]

Historical collections and archives of scientific data bear out Myrdal's claims. Additionally, it appears that the study of history through these archives, when used in conjunction with the "rewritten" history created by contemporary scientists, becomes much more articulated. The data contained in historical archives and data sets tells the historian as much about the surrounding milieu in which the science was created as it does about the science itself. Surprisingly, the research need not be of high quality scientifically to serve its historical charge. Biases, circumstances, and methods betray the scientists of their objective pretense and expose to a new paradigm the rich environmental influences which were at work in the previous era. Because the scientist cannot perceive the changes in the social fabric and thought that the next paradigm will hold, he will always inadvertently include such telling information.

Much of the time, however, scientific archives, collections, and databases are discarded. Those which escape destruction invariably remain of service to scientists and historians for reasons which lie completely outside the aims of their initial creation. This thesis examined the fates of three scientific photographic archives in history at different points along the evolution of their respective paradigms.

Louis Agassiz and Samuel Morton, champions of the American school of polygeny, struggled to find ways to account for the accumulating fund of knowledge which indicated relationships between species. Their precepts of separate creations, plagued by *a priori* expectations and religious beliefs, clearly primed the floodgates for Darwin's theories of evolution. The polygenists thus illustrate the thrashing expiration of one paradigm at the institution of another. Despite the collections' gradually acquired sensitive nature in the context of the new paradigm--the frankly racist connotations, the biased research, and the prominent role that the polygenists played in forming American social policy--the archives managed to survive. The scientific collections proved useful from a scientific standpoint: Stephen Jay Gould utilized Morton's old data sets and skull collection to retrace one aspect of the foundations of biologic determinism. Additionally, Agassiz's surviving daguerreotypes, taken initially to undermine the solidarity of the human race as one species, are now precious as the earliest surviving photographs of African-Americans in this country.

Harvey Cushing's Brain Tumor Registry, exhibits a different sort of utility to modern scholars and historians. Dr. Cushing represents the vast and furious

accumulation of knowledge which occurs with the commencement of a new paradigm. Cushing's serendipitous proximity to Osler, Halsted, and the "Berne school" of surgical technique opened the door to him the possibility of operating in the new frontier: the human brain. His devotion toward the innovation of new techniques in anesthesia, hemostasis, septic hygiene, and his insatiable propensity to observe, document, and publish his clinical results brought neurosurgery from a nearly unanimously fatal act of desperation to its seat as a legitimate surgical subspecialty. Cushing managed to accomplish this in little over thirty years.

A recent review of the materials belonging to Cushing's Brain Tumor Registry, dormant for decades below the medical student dormitory at Yale yielded surprising results. Clearly Harvey Cushing had his own weaknesses as a researcher, but the materials belonging to the Registry lend the observer a rare window onto the sometimes shocking practice of medicine, and the development of a brand new specialty at the earliest part of the twentieth century. Blind to knowing which symptoms, signs and procedures might become significant, he observed and recorded prolifically, leaving for us the physical record of his endeavors. However, age leant the materials an unexpected patina: the images and records from the Registry transcended their original scientific utility to become objects d' art. The hallowing, beautiful, and often macabre photographic negatives, some 15,000 of them, tell the tale of human misery, bravery, suffering, and triumph. They are at once valuable for their antiquity and timeless emotional undercurrent.

Dr. William H. Sheldon's theories of constitutional psychology provide the final example of historical collections and their roles in new paradigms. Sheldon began his work within the context of an optimistic pre-Third Reich scientific community excited about the possibilities of the gene. He hoped to establish what to him must have seemed obvious--a reliable, objective link between human morphology and function. However, he remained unable to accommodate the plethora of social-scientific variables which influence the relationship. His studies, ripe with a priori convictions, conjecture, and bias seemed even to evade the more stringent mid-20th century research paradigm. Additionally, Sheldon witnessed the change of tides in contemporary thinking about individual differences brought about in the second half of the 1900's. Ironically, despite his impressive toil to validate constitutional psychology as a legitimate science, Sheldon's research seems to have had little impact on the change of paradigms. He enjoyed a short period in which his theories attracted attention (and even led to their implementation at the

Hayden Goodwill Inn for boys), but they were quickly discarded largely because Sheldon, despite his ardor, pursued a misguided hypothesis with embarrassingly subjective methods. W.H. Sheldon never accepted the null hypothesis in his research.

Interestingly, however, Sheldon produced an impressive bank of photographs of his subjects, men and women pictured nude in three poses from the 1930's until the early 70's. He also retained records of psychological testing performed on some of the individuals. Much of his archive had been lost, scattered, and destroyed by the individual academic institutions where the work was performed. However, a significant portion remained. Unfortunately, somewhat sensationalist coverage of Sheldon and his work in the lay press led to the perish of much of what originally escaped destruction. Myopic contemporary conceit thus insured that Sheldon's photographs would never ferment--they are forever lost to scientists and historians who will be working within the luxury of a fresh frame of reference in the next social, political, and scientific paradigm.

Surely, as scientists and historians we are blind to the future. Almost as surely, our vision of the past is also obscured by the nature of paradigmatic change, and the scientific amnesia that accompanies it. Historic fact, it would seem, lay not only in the saved journals, books, and writings of the scientists, which are invariably modified or discarded with passing modes of thought; but also in the written, photographic, and now computerized data sets used toward the elucidation of knowledge. Clearly it is impossible to archive every piece of factual detail accumulated under the guise of science, but scientists and historians have a responsibility--a moral imperative to preserve surviving data sets regardless of their implications for members of the current paradigm. Facts can be merciless to humankind; but we, indeed, are equally merciless to fact.

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[30]Thomson, p. 140.
[31]*Ibid.*, p. 140.
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[33]Modlin, p. 439.
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[35]Fulton, p. 249-50.
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